

# HYDROGEOLOGY AND GROUNDWATER QUALITY OF THE GLACIATED VALLEYS OF BRADFORD, TIoga, AND POTTER COUNTIES, PENNSYLVANIA

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Prepared by the United States Geological Survey,  
Water Resources Division, in cooperation with  
the Pennsylvania Geological Survey

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PENNSYLVANIA GEOLOGICAL SURVEY

FOURTH SERIES

HARRISBURG

1998

**When reproducing material from this book, please cite the source as follows:**

**Williams, J. H., Taylor, L. E., and Low, D. J., 1998, Hydrogeology and ground-water quality of the glaciated valleys of Bradford, Tioga, and Potter Counties, Pennsylvania: Pennsylvania Geological Survey, 4th ser., Water Resource Report 68, 89 p.**

**Pennsylvania World Wide Web site: <http://www.state.pa.us>**

**Department of Conservation and Natural Resources  
World Wide Web site: <http://www.dcnr.state.pa.us>**

**ISBN: 0-8182-0169-X**

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## **ERRATA**

### **PLATE 1A**

The paragraph shown below under the heading "Water-Bearing Properties" replaces the two paragraphs under the same heading on Plate 1A for the units alluvium and Olean outwash, undifferentiated (Qaoo), Olean ice-contact deposits (Qoic), and Olean deltaic deposits (Qod).

<b>UNIT</b>	<b>WATER-BEARING PROPERTIES</b>
ALLUVIUM AND OLEAN OUTWASH, UNDIFFERENTIATED  Qaoo	Alluvium is generally too thin to be an aquifer; however, it can be a major source of recharge to underlying units. Outwash occurs under unconfined conditions. Ice-contact and deltaic deposits occur under confined (overlain by 10 feet or more of lacustrine silt and clay) and unconfined conditions. Median specific capacities for wells completed in confined and unconfined aquifers are 11 and 24 (gal/min)/ft, respectively. Median available drawdowns for wells completed in confined and unconfined aquifers are 85 and 35 feet, respectively. Water in confined and unconfined aquifers has a median hardness of 150 and 110 mg/L (hard and moderately hard) and a median dissolved-solids concentration of 230 mg/L and 180 mg/L (both moderate), respectively. About 70 percent of the wells completed in confined aquifers and 20 percent of the wells completed in unconfined aquifers contain water that exceeds the recommended limits for iron and manganese. Although water of the sodium chloride type occurs in some of the confined aquifers where groundwater movement is restricted, water of the calcium bicarbonate type is dominant.
OLEAN ICE-CONTACT DEPOSITS  Qoic	
OLEAN DELTAIC DEPOSITS  Qod	

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by

John H. Williams,<sup>1</sup> Larry E. Taylor,<sup>2</sup> and Dennis J. Low<sup>3</sup>

## ABSTRACT

The most important sources of groundwater in Bradford, Tioga, and Potter Counties are the stratified-drift aquifers. Saturated sand and gravel primarily of outwash origin forms extensive unconfined aquifers in the valleys. Outwash is underlain in most major valleys by silt, clay, and very fine sand of lacustrine origin that comprise extensive confining units. The lacustrine confining units locally exceed 100 feet in thickness. Confined aquifers of ice-contact sand and gravel are buried locally beneath the lacustrine deposits. Bedrock and till are the basal confining units of the stratified-drift aquifer systems.

Recharge to the stratified-drift aquifers is by direct infiltration of precipitation, tributary-stream infiltration, infiltration of unchannelled runoff at the valley walls, and groundwater inflow from the bedrock and till uplands. Valley areas underlain by surficial sand and gravel contribute about 1 million gallons per day per square mile of water from precipitation to the aquifers. Tributary streams provide recharge of nearly 590 gallons per day per foot of stream reach. Water is added at the rate of 1 million gallons per day per square mile of bordering uplands not drained by tributary streams to the stratified-drift aquifers from unchannelled runoff and groundwater inflow.

Induced infiltration can be a major source of recharge to well fields completed in uncon-

fined stratified-drift aquifers that are in good hydraulic connection with surface water. The well fields of an industrial site in North Towanda, a public-water supplier at Tioga Point, and the U.S. Fish and Wildlife Service at Asaph accounted for 75 percent of the 10.8 million gallons per day of groundwater withdrawn by public suppliers and other selected users in 1985. The well fields tap stratified-drift aquifers that are substantially recharged by induced infiltration or tributary-stream infiltration.

Specific-capacity data from 95 wells indicate that most wells completed in stratified-drift aquifers have specific capacities an order of magnitude greater than those completed in till and bedrock. Wells completed in unconfined stratified-drift aquifers and in bedrock aquifers have the highest and lowest median specific capacities—24 and 0.80 gallons per minute per foot of drawdown, respectively. Wells completed in confined stratified-drift aquifers and in till have median specific capacities of 11 and 0.87 gallons per minute per foot of drawdown, respectively.

The results of 223 groundwater-quality analyses indicate two major hydrogeochemical zones: (1) a zone of unrestricted groundwater flow that contains water of the calcium bicarbonate type (this zone is found in almost all of the stratified-drift aquifers, till, and shallow bedrock systems); and (2) a zone of restricted groundwater flow that contains water of the sodium chloride type (this zone is found in the bedrock, and, in some areas, in till and confined stratified-drift aquifers). Samples pumped from wells that penetrate restricted-flow zones have median concentrations of total dissolved solids, dissolved chloride, and dissolved barium of 840

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and 350 milligrams per liter, and 2,100 micrograms per liter, respectively.

Excessive concentrations of iron and manganese are common in the groundwater of the study area; about 50 percent of the wells sampled contain water that has iron and manganese concentrations that exceed the U.S. Environmental Protection Agency secondary maximum contaminant levels of 300 and 50 micrograms per liter, respectively. Only water in the unconfined stratified-drift aquifers and the Catskill Formation has median concentrations lower than these limits.

## INTRODUCTION

In the valleys of north-central Pennsylvania, stratified-drift aquifers are the most important source of water for municipal, industrial, and domestic use. In 1983, the U.S. Geological Survey, in cooperation with the Pennsylvania Bureau of Topographic and Geologic Survey, began an investigation of the hydrogeology and groundwater quality of the glaciated valleys of Bradford, Tioga, and Potter Counties. The investigation is part of a continuing appraisal of the groundwater resources of the Commonwealth by the U.S. Geological Survey and the Bureau.

This report contains descriptions of the hydrogeologic setting and hydrogeochemical system in the glaciated valleys of north-central Pennsylvania. The geometry of the stratified-drift aquifers is presented in a series of maps and cross sections. Tables of groundwater use, stream-infiltration rates, well and test-hole records, specific-capacity data, and results of groundwater-quality analyses are included, as well as statistical analyses of well yield and water quality in the stratified-drift aquifers, till, and bedrock.

## DESCRIPTION OF THE STUDY AREA

The area of investigation includes river and stream valleys north of the late Wisconsinan glacial border in Bradford, Tioga, and Potter Counties (Figure 1). It is within the Allegheny Plateaus section of the Appalachian Plateaus physiographic

province. The Allegheny Plateaus section is a dissected plateau with flat-topped hills separated by steep-sided river and stream valleys.

Most of the study area, including all of Bradford and Tioga Counties, is in the Susquehanna River basin. The northeastern corner of Potter County is in the headwaters area of the Genesee and Allegheny River basins. Streams flowing through the major valleys include the Susquehanna and Chemung Rivers and Wysox, Towanda, Sugar, Bentley, South, and Wyalusing Creeks in Bradford County; the Tioga and Cowanesque Rivers and Pine, Marsh, Crooked, and Babb Creeks in Tioga County; and the Genesee River and Oswayo and Elevenmile Creeks in Potter County (Figure 1).

The area is sparsely populated, and the largest concentrations of people are in the major valleys. Population centers include Sayre, Towanda, Wysox, and Canton in Bradford County; Lawrenceville, Cowanesque, Mansfield, Blossburg, and Wellsboro in Tioga County; and West Bingham and Shinglehouse in Potter County (Figure 1).

## METHODS OF INVESTIGATION

Methods used in the investigation included mapping of surficial geology; drilling of test holes; collection and analysis of well logs, test-hole logs, and pumping data; geophysical logging of boreholes; surface and water-borne geophysical surveys; measurement of groundwater levels; stream-infiltration studies; and sampling and analysis of groundwater quality. Hydrogeologic data were collected from about 900 wells and test holes. The records of wells and test holes are presented in Table 21; their locations are shown on Plates 1A and 1B. Seven test holes were drilled to supplement the available hydrogeologic data. Five of the test holes were drilled by air-rotary or cable-tool methods and two holes were drilled by the hollow-stem auger method.

Borehole-geophysical logs were obtained from 30 wells to supplement available hydrogeologic and well-construction data. The geophysical logs include caliper, temperature, fluid-resistivity, and gamma-ray logs. Examples of gamma-ray logs and interpreted lithologies for three selected wells are shown in Figure 2.

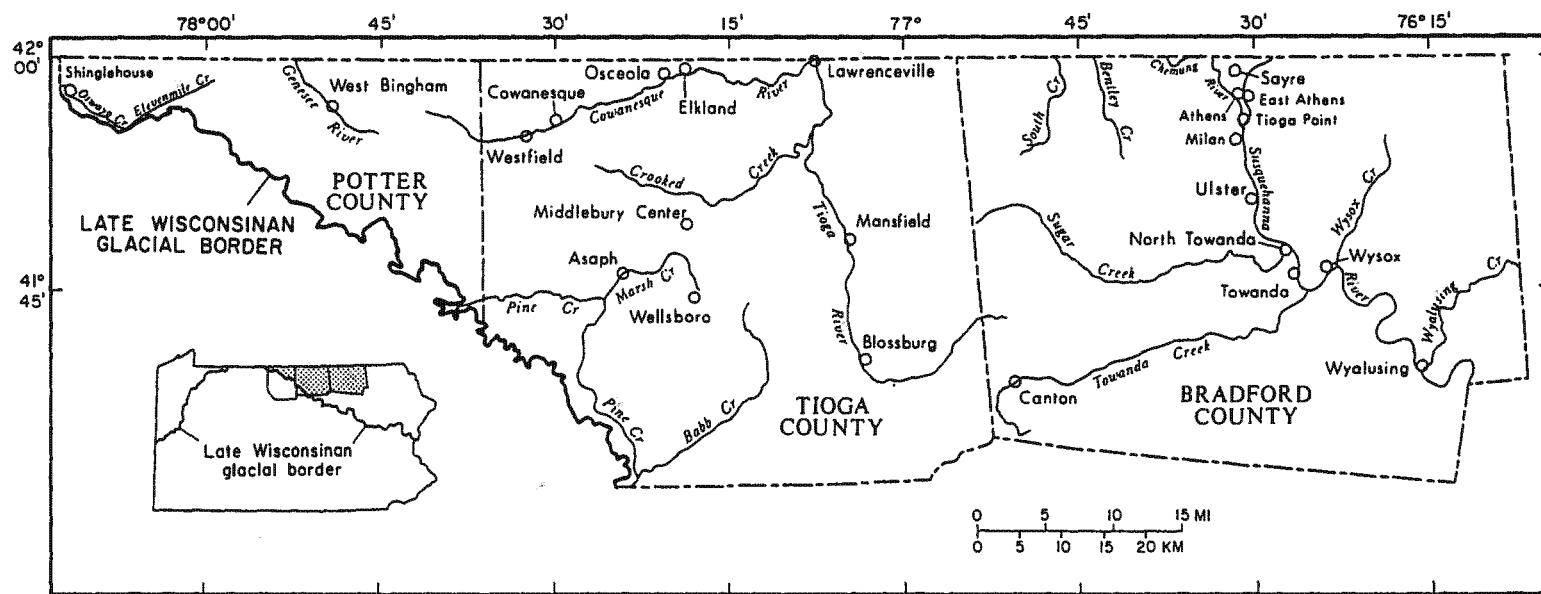


Figure 1. Location of the study area, major streams, late Wisconsinan glacial border, and population centers (glacial border is from Crowl and Sevon, 1980).

Surface and water-borne geophysical surveys, including direct-current resistivity, seismic refraction, and seismic reflection, were completed to supplement available hydrogeologic data. Direct-current resistivity soundings were completed at 34 sites, shown on Plates 1A and 1B. The direct-current resistivity method was explained in detail by Zohdy and others (1974). The Schlumberger electrode array was used in this study and the data were interpreted with the aid of a computer program developed by Zohdy (1969). Figure 3 shows examples of interpreted resistivity soundings at three selected sites.

Seismic-refraction surveys were done at two sites, the locations of which are shown on Plates 1A and 1B. Zohdy and others (1974) and Haeni (1986) described applications of the seismic-refraction technique to groundwater investigations. The

seismic-refraction data were interpreted with the aid of a computer program developed by Scott and others (1972).

Continuous seismic-reflection profiling was done along the Susquehanna and Chemung Rivers in northern Bradford County, as shown on Plate 1A. The seismic-profiling technique was described in detail by Sangree and Widmier (1979). Figures 4 and 5 show two examples of the raw and interpreted seismic records.

Groundwater levels were recorded continuously at six wells for selected periods during water years<sup>1</sup> 1983–85. Two sets of synchronous groundwater-level measurements were made at 80 wells near Sayre and North Towanda, Bradford County, and Asaph, Tioga County.

<sup>1</sup>A water year extends from October 1 through September 30 and is designated by the calendar year in which it ends.

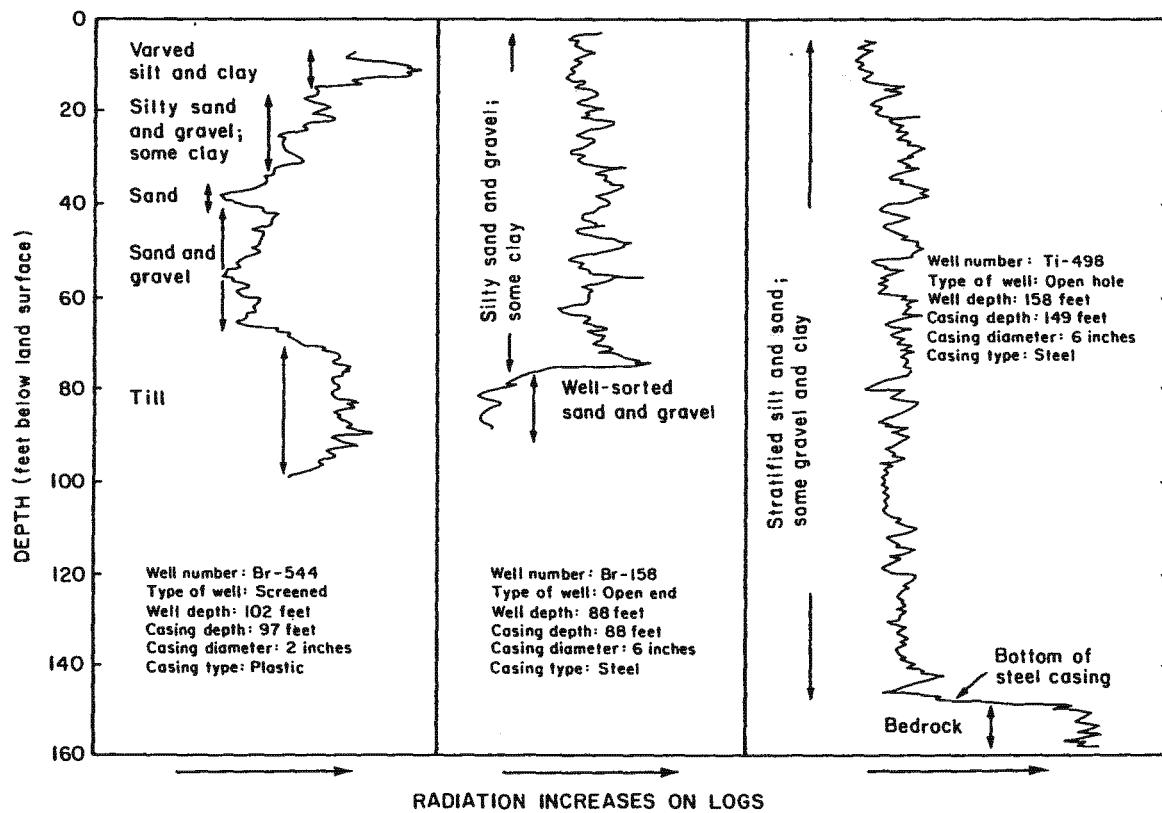


Figure 2. Examples of gamma-ray logs and interpreted lithologies at three selected wells.

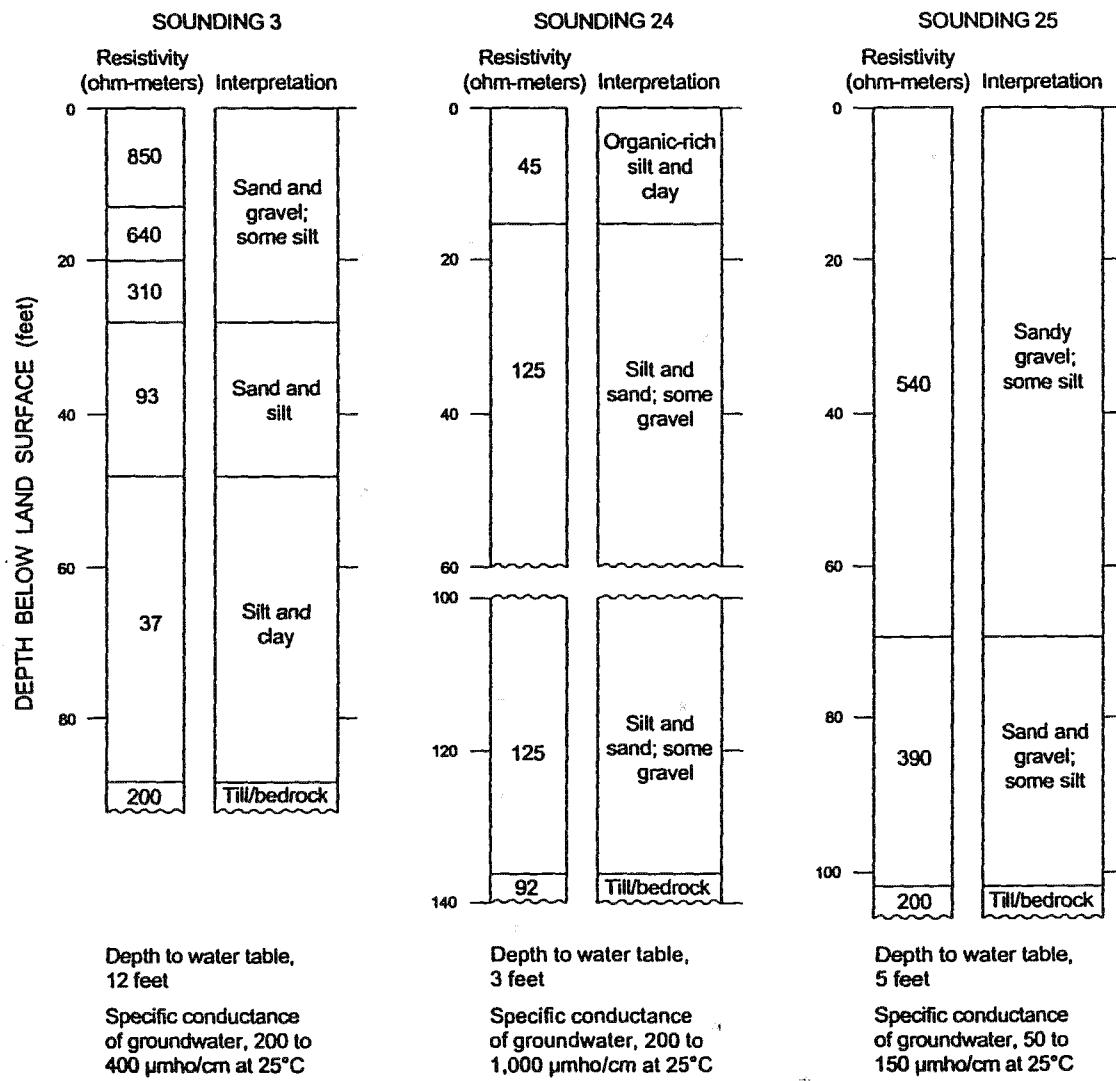


Figure 3. Examples of interpreted resistivity soundings at three selected sites.

Seepage investigations were completed along 13 tributaries during water years 1983–85. Repeated discharge measurements were made along eight of these tributary streams over a wide range of streamflows. Discharge-measurement sites were established along each tributary stream where the stream enters the main valley, and within the main valley.

Specific conductance and total hardness of water from about 220 wells were measured in the

field. Water-quality samples were collected from more than 200 wells for laboratory analysis of major cations and anions, nutrients, and trace metals. Water-quality samples were collected from 10 wells for laboratory analysis of gross-alpha and gross-beta radioactivity and radium. Methods used for field determinations and preparation of samples for laboratory analysis were described by Brown and others (1970) and Wood (1976).

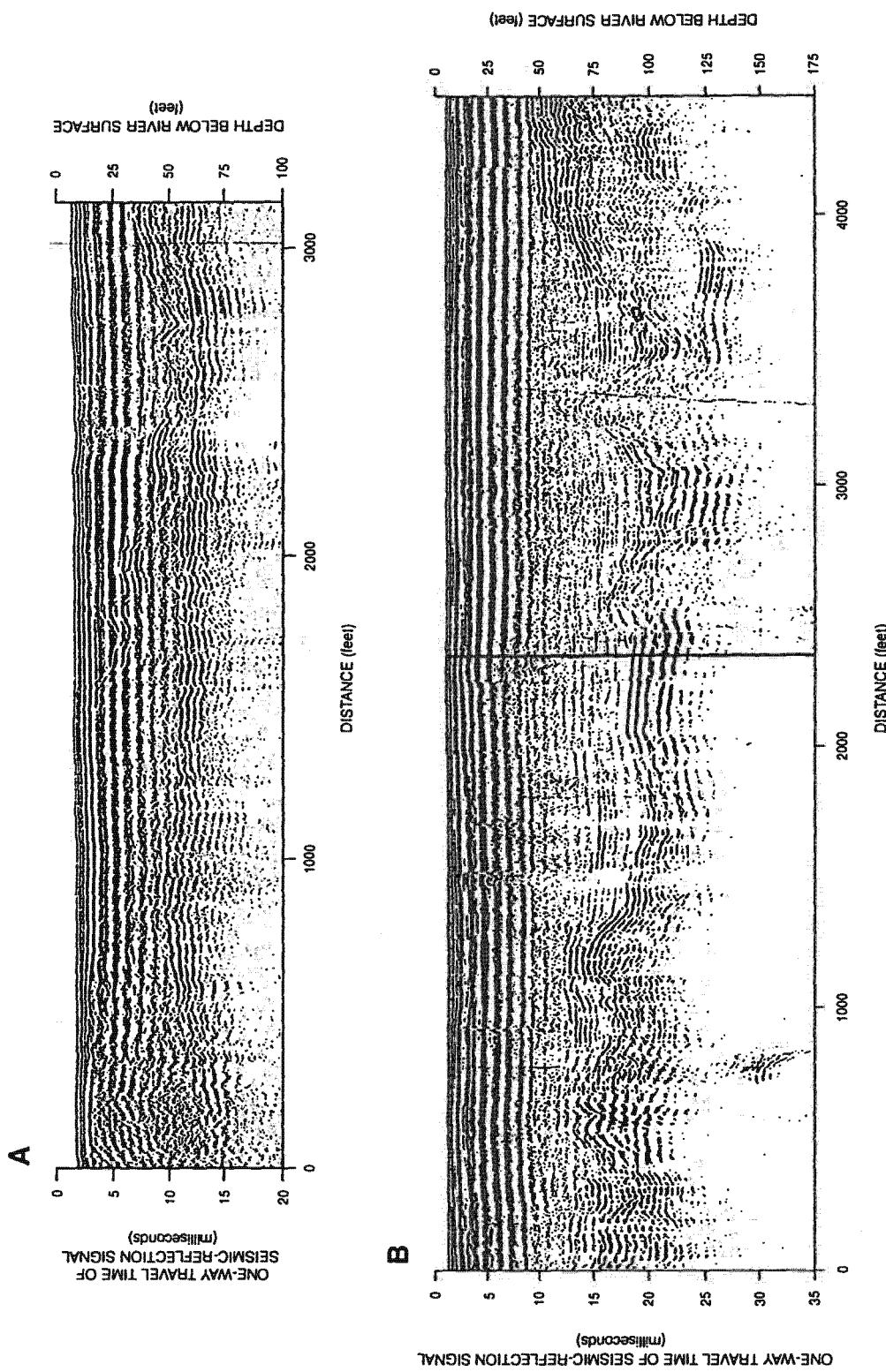


Figure 4. Seismic-reflection records along the Susquehanna River at Milan, Bradford County (A); and Ulster, Bradford County (B).

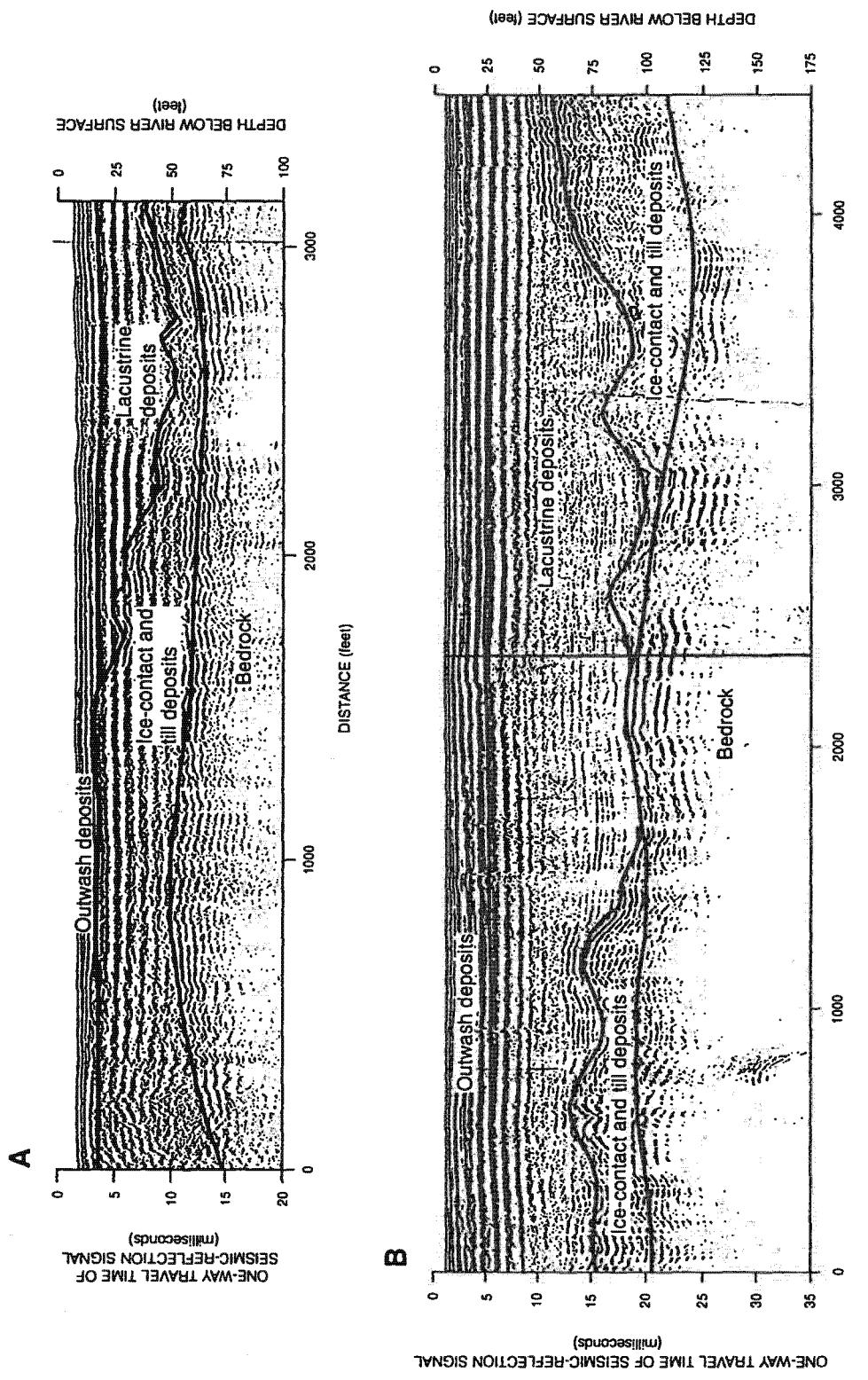


Figure 5. Interpretations of seismic-reflection records shown in Figure 4.

## PREVIOUS INVESTIGATIONS

Previous groundwater investigations in the study area include those by Lohman (1939), Taylor and others (1983), and Taylor (1984). The hydrogeologic and water-quality data collected during these regional studies, and seismic-reflection profiling by Reynolds and Williams (1988), were incorporated into the present investigation. In addition, the thesis work of Werkheiser (1987) in the Sayre-Athens-Waverly area was coordinated with the present study.

## ACKNOWLEDGMENTS

We gratefully acknowledge the homeowners, public officials, and company representatives who allowed access to their property and helped in data collection. Special thanks go to Michael Smith of the U.S. Fish and Wildlife Research and Development Center at Asaph, Stanley Poss and Edward Sick of GTE Sylvania at North Towanda, and Bruce Hoffman of Dupont and Company at North Towanda. Geologic logs by the W. H. Vanderhoof Drilling Company from wells drilled in northern Bradford County over the past 20 years were extremely helpful in this investigation.

## HYDROGEOLOGY GEOLOGIC SETTING

The study area is underlain by nearly flat-lying sedimentary bedrock and unconsolidated deposits of glacial and postglacial origin. The bedrock consists primarily of shale, siltstone, and sandstone of Devonian to Pennsylvanian age. The sedimentary rocks record a general transition from marine to deltaic and finally to fluvial depositional environments. At the end of the Paleozoic Era, the area was broadly folded into a series of low-amplitude anticlines and synclines trending northeast-southwest.

During the Pleistocene Epoch, continental glaciers repeatedly advanced southward from Canada across central New York and covered the study area. The glacial ice eroded the bedrock and deepened and widened preexisting valleys. During deglacia-

tion in the late Wisconsinan, which began about 15,000 years ago (Crowl and Sevon, 1980), the valleys were partly filled with sediments deposited by glacial ice, meltwater, and proglacial lakes, and the uplands were mantled with till. In postglacial time, streams deposited alluvium on modern floodplains and formed alluvial fans, and organic-rich deposits accumulated in poorly drained depressions. A generalized deglaciation sequence and associated depositional environments and deposits are illustrated in Figure 6.

## Bedrock

The glaciated valleys and surrounding uplands are underlain by bedrock of Devonian, Mississippian, and Pennsylvanian age (Figure 7). The Devonian bedrock includes, from oldest to youngest, the Lock Haven, Catskill, and Chadakoin<sup>1</sup> Formations, and commonly consists of interbedded shale, siltstone, and sandstone. The Chadakoin Formation crops out only in the westernmost part of the study area, whereas the Lock Haven Formation underlies most of the major valleys. The Catskill Formation underlies some of the major valleys in the southern and western parts of the study area (Figure 7), and much of the uplands. In general, the Catskill Formation is less calcareous and coarser grained than the Lock Haven Formation.

The Huntley Mountain Formation is of Mississippian and Devonian age and underlies the Mississippian Burgoon Formation. Most outcrops of the Huntley Mountain Formation, which consists of interbedded sandstone and shale, are exposed on hilltops in the central and northern parts of the region. In southern Bradford and Tioga Counties, the resistant sandstone of the Burgoon Formation forms synclinal ridges. The Allegheny and Pottsville Groups of Pennsylvanian age are commonly exposed in the cores of Burgoon ridges. The Allegheny and Pottsville Groups consist of sandstone and shale and contain some economical deposits of coal.

Ferguson (1974) and Wyrick and Borchers (1981) observed that, in nonglaciated valleys of the

<sup>1</sup>The Chadakoin Formation is a stratigraphic name used by the Pennsylvania Bureau of Topographic and Geologic Survey only, not by the U.S. Geological Survey.

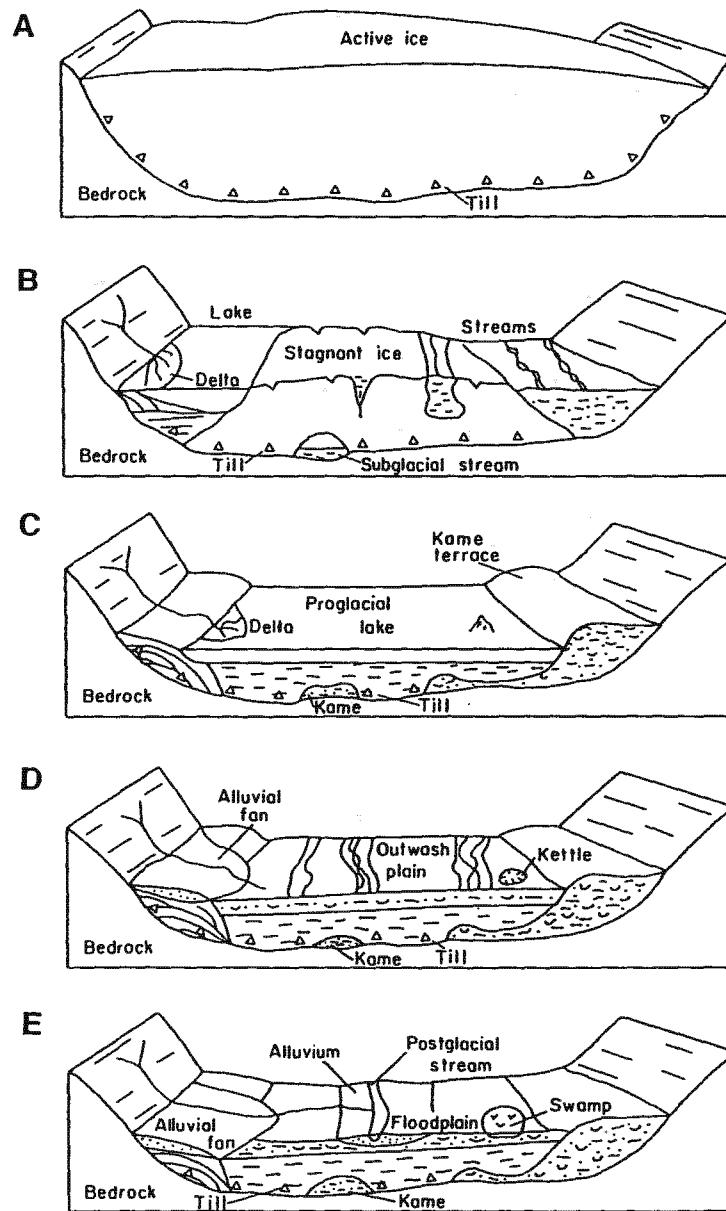


Figure 6. Generalized diagrams of a possible deglaciation sequence, including selected depositional environments and associated deposits (modified from Reynolds and Brown, 1984, Figure 3, p. 9). A, Active glacial ice fills the valleys, scouring the valley floors and valley walls; B, During deglaciation, shrinking ice partially fills the valleys; ice marginal streams and lakes develop; fluvial, deltaic, and lacustrine sediments are deposited; C, Dams are formed by either stagnant ice blocks or sediment; meltwater lakes form in front of the retreating ice margin; thick lacustrine sediments are deposited; D, The ice margin continues to retreat; dams either melt or are breached; lacustrine sediments are buried by outwash from the retreating glacier; E, During the postglacial period, modern streams incise the outwash and periodically deposit alluvium on the floodplain.

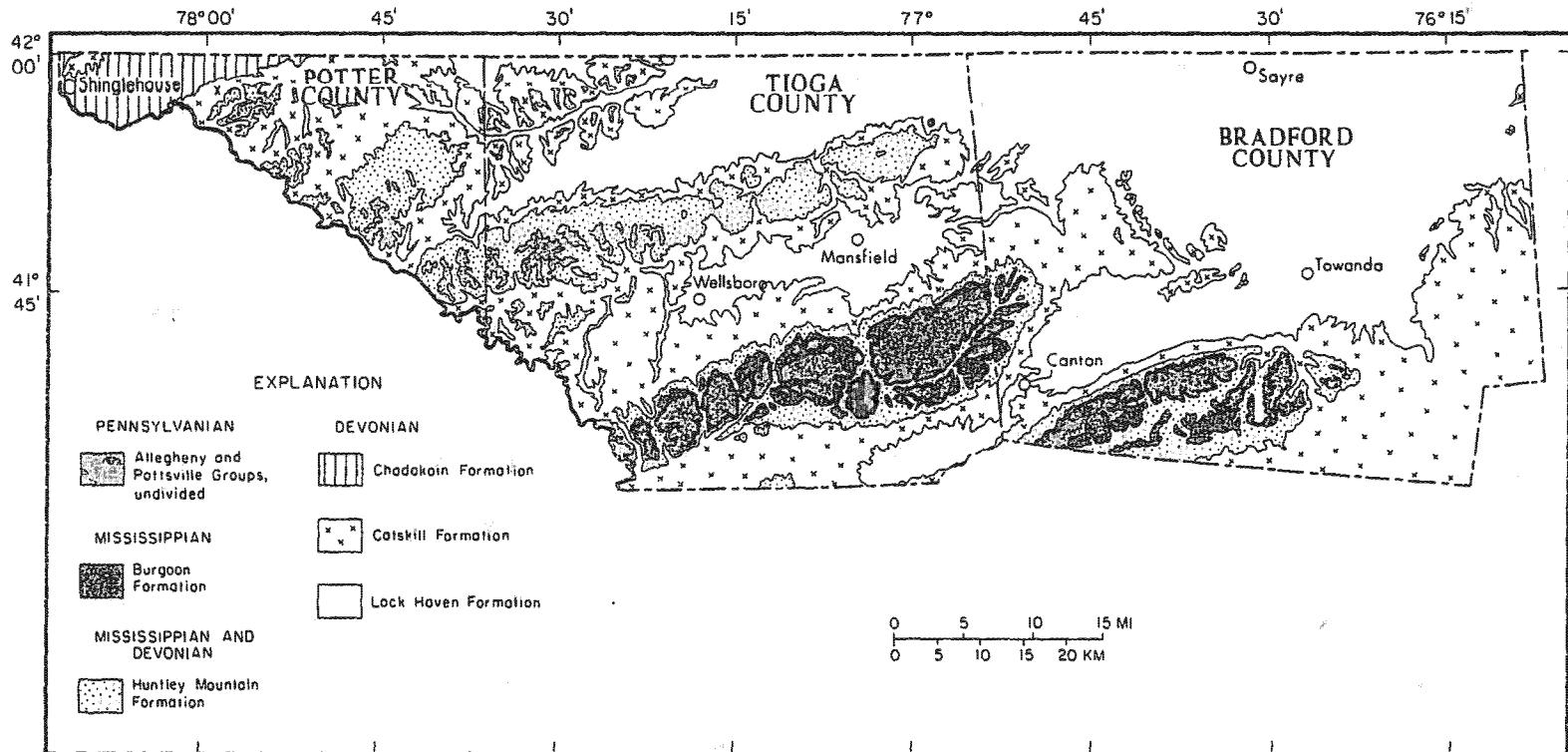


Figure 7. Bedrock geology of the study area.

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Appalachian Plateau, the upper part of the bedrock is highly fractured as a result of stress-relief processes. In major valleys of the study area, glacial ice probably eroded most of the bedrock that had significant stress-relief fractures. As much as 50 feet to more than 100 feet of bedrock may have been removed.

### Glacial and Postglacial Deposits

Glacial and postglacial valley-fill sediments consist of till, stratified drift, alluvium, and swamp deposits. Stratified drift includes ice-contact deposits, lacustrine and deltaic deposits, and outwash. The surficial geology of the study area is shown on Plates 1A and 1B.

#### Till

Till is a nonsorted mixture of clay, silt, sand, and rock fragments that was directly deposited by glacial ice (Figure 6A). In most areas, till directly overlies bedrock and is less than 20 feet thick. Near the valley walls and in upland valleys, till may be more than 50 feet thick and may contain isolated beds of sand and gravel, especially near its base. The lithology of the till is largely controlled by the lithology of the underlying bedrock. The till matrix is primarily silty in areas underlain by Devonian bedrock. Most of the rock fragments are from local bedrock, although igneous, metamorphic, and limestone fragments derived from New York or Canada are also present.

#### Ice-Contact Deposits

Ice-contact stratified drift consists of poorly to well-sorted sand, gravel, silt, and clay that were deposited by meltwater in close proximity to glacial ice (Figure 6B). The sediments were deposited as kame terraces, deltas, and fans; outwash heads; and fillings in crevasses and other openings within melting glacial ice. Ice-contact deposits commonly are present along the walls of the valleys. Maximum thickness of the valley-wall deposits is about 100 feet. Localized deposits of ice-contact sand and gravel are buried beneath outwash and fine-grained lacustrine sediments and directly overlie till or bedrock. The origin of these deposits is not well understood, but they probably include subglacial and

slumped deposits. Most buried deposits are less than 30 feet thick and, in many areas, consist only of a thin zone of reworked or "washed" till.

#### Lacustrine and Deltaic Deposits

Lacustrine beds of silt, clay, and very fine sand that were deposited in proglacial lakes typically form the thickest units in the major valleys (Figure 6C). In general, the greater the depth to bedrock, the greater the thickness of the lacustrine deposits. Thicknesses of more than 100 feet of fine-grained deposits are not uncommon. The upper surface of the lacustrine deposits typically is an erosional contact with outwash. Locally, deltaic deposits overlie or are interbedded with the lacustrine deposits. These sediments, which consist of fine to coarse sand and some silt and gravel, were deposited as deltas that spread into the proglacial lakes.

#### Outwash

Outwash consists of variably silty sand and gravel deposited as valley trains by glacial meltwater (Figure 6D). The gravels are well rounded and commonly consist of resistant lithologies, including sandstone, limestone, and igneous and metamorphic rocks. The outwash is overlain by alluvium in the floodplain and forms terraces above the floodplain. The thickness of outwash typically ranges from 20 to 40 feet but is as much as 70 feet thick in some areas.

#### Alluvium

Alluvium was deposited by the modern drainage system during postglacial time (Figure 6E). Alluvium covers the floodplains of rivers and major streams and fans of upland tributary streams. In major valleys, the lower part of the floodplain alluvium consists of stratified sand and gravel and is found only in areas where the modern river or stream has meandered. Most of the gravel in this basal alluvium has been reworked from outwash deposits. The upper part of the alluvium is comprised of overbank deposits of silt and fine sand. Floodplain alluvium typically overlies outwash and has a maximum thickness of 20 feet, almost all of which is above the modern river level.

Alluvial fans formed at the mouths of upland valleys where tributary streams entered the major valleys. Upland valley alluvium and alluvial fan deposits consist of silty sand and gravel that is typically less than 20 feet thick.

#### *Swamp Deposits*

Organic-rich silt and clay were deposited in low-lying areas during postglacial time. Some of these poorly drained depressions developed where ice blocks melted during deglaciation (Figure 6C-6E). Most swamp deposits are less than 20 feet thick.

### AQUIFER GEOMETRY AND HYDROLOGIC CHARACTERISTICS

The generalized geometry of the stratified-drift aquifer systems in the major valleys is shown in Figure 8. The hydrogeologic framework of the stratified-drift aquifer systems along selected cross sections in the study area is shown on Plates 1A and 1B. Bedrock and till are the basal confining units for the overlying stratified-drift aquifers. Till has a low permeability because it is poorly sorted and typically highly compacted. Permeability in the bedrock is dependent on fractures and, in the major valleys, much of the fractured rock has been removed by glacial erosion. Locally, fractures in the shallow bedrock may be in hydraulic connection with overlying stratified drift where the till is absent. In most of the major valleys, lacustrine deposits of silt, clay, and very fine sand comprise a thick and areally extensive confining unit. Localized, confined aquifers of ice-contact sand and gravel are buried beneath the lacustrine unit.

Although areally extensive, surficial sand and gravel may be only thinly saturated over much of the valley. Where they are saturated, surficial sand and gravel in alluvium, outwash, deltaic deposits, and ice-contact deposits form unconfined aquifers in the valley. The unconfined aquifers primarily consist of outwash, although locally, significant saturated thicknesses of deltaic and ice-contact deposits are present. The base of the unconfined aquifers is the contact between the outwash sand and gravel and the underlying lacustrine or bedrock/till con-

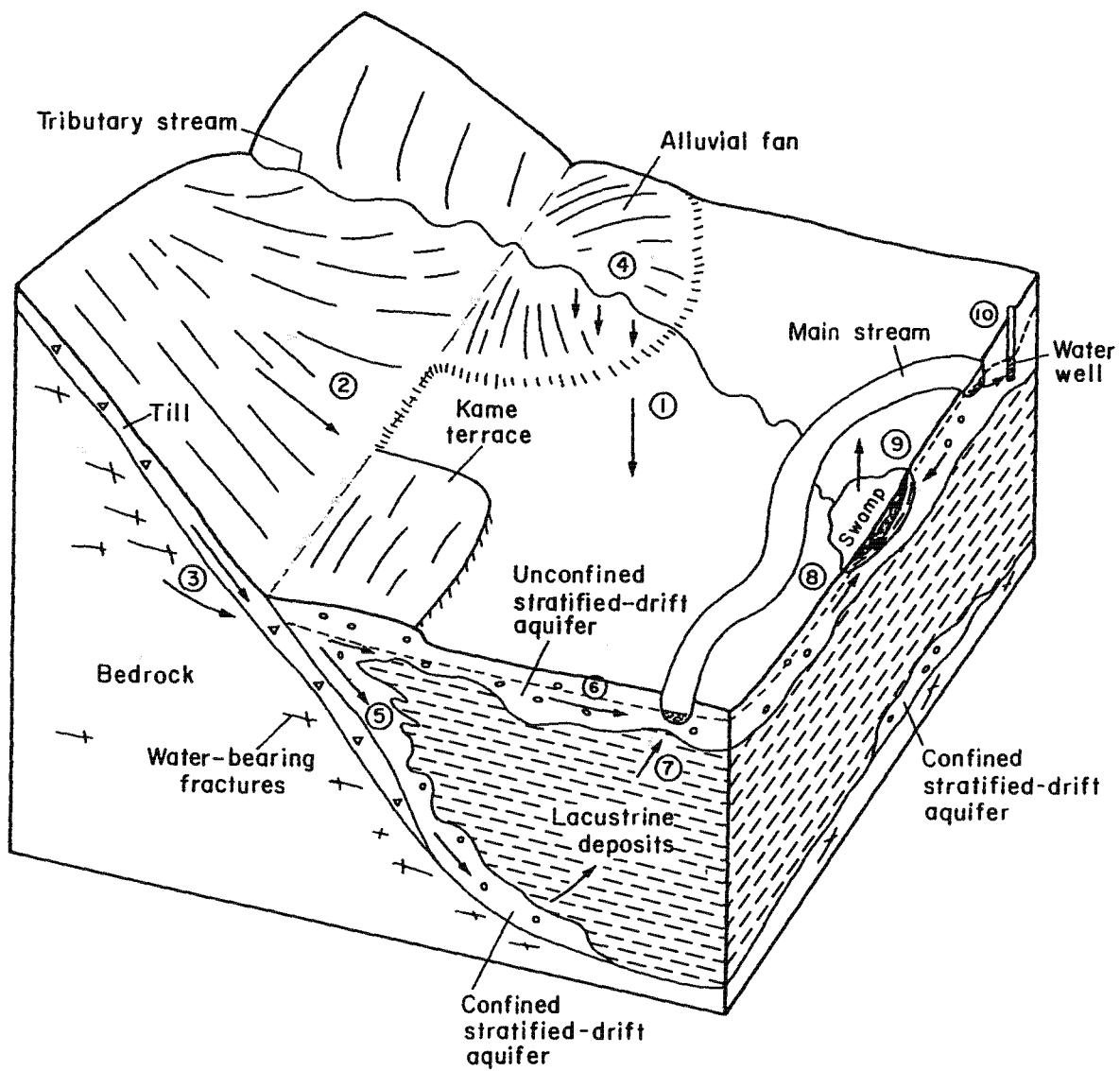
fining units. The presence of fine-grained swamp deposits results in locally confined conditions in the unconfined aquifers. Figures 9 and 10 show selected hydrogeologic characteristics of the unconfined stratified-drift aquifers in the Sayre-Athens-Milan and North Towanda areas.

In upland valleys, lacustrine deposits are not extensive. Unconfined aquifers consist generally of alluvium, relatively thin outwash, and ice-contact deposits, and, where till is thin or absent, fractured bedrock. Where thick till deposits are present, local sand and gravel beds within the till (typically at its base) and fractured bedrock form confined aquifers.

### GROUNDWATER RECHARGE, FLOW, AND DISCHARGE

Sources of natural recharge to the stratified-drift aquifer systems in the study area include: (1) infiltration of precipitation on the valley floor; (2) infiltration of unchannelled runoff from the bedrock and till uplands at the valley walls; (3) groundwater inflow from the bedrock and till uplands; and (4) infiltration from tributary streams (Figure 8). In valley areas underlain by surficial sand and gravel, surface runoff is negligible and nearly all precipitation that is not lost to evapotranspiration recharges the aquifer. Valley areas underlain by swamp deposits or other fine-grained sediments receive less recharge. Average annual precipitation in the study area ranges from 34 to 38 inches, about 50 percent of which is lost to evapotranspiration (Taylor and others, 1983; Taylor, 1984). Therefore, the average recharge rate from precipitation on the valley is about 18 in./yr (inches per year) or approximately 1 (Mgal/d)/mi<sup>2</sup> (million gallons per day per square mile) of valley floor. MacNish and Randall (1982) reported recharge rates ranging from 0.8 to 1.2 (Mgal/d)/mi<sup>2</sup> for the Susquehanna River basin in New York.

Adjacent upland areas that are not drained by tributary streams provide recharge to the stratified drift by infiltration of unchannelled runoff and groundwater inflow at the valley walls. Unchannelled surface runoff and shallow groundwater flow through till and fractured bedrock recharge the stratified-drift aquifer at the base of the uplands, except where



## EXPLANATION

- |   |  |
|---|--|
| 1 Precipitation on valley                           | 5 Groundwater recharge to confined aquifer |
| 2 Unchannelled runoff from bedrock and till uplands | 6 Discharge to main stream                 |
| 3 Groundwater inflow from bedrock and till uplands  | 7 Upward leakage through confining unit    |
| 4 Infiltration from tributary streams               | 8 Groundwater discharge to swampy areas    |
|   | 9 Evapotranspiration                       |
|   | 10 Induced infiltration by pumping         |

Figure 8. Generalized geometry and hydrology of the stratified-drift aquifer systems.

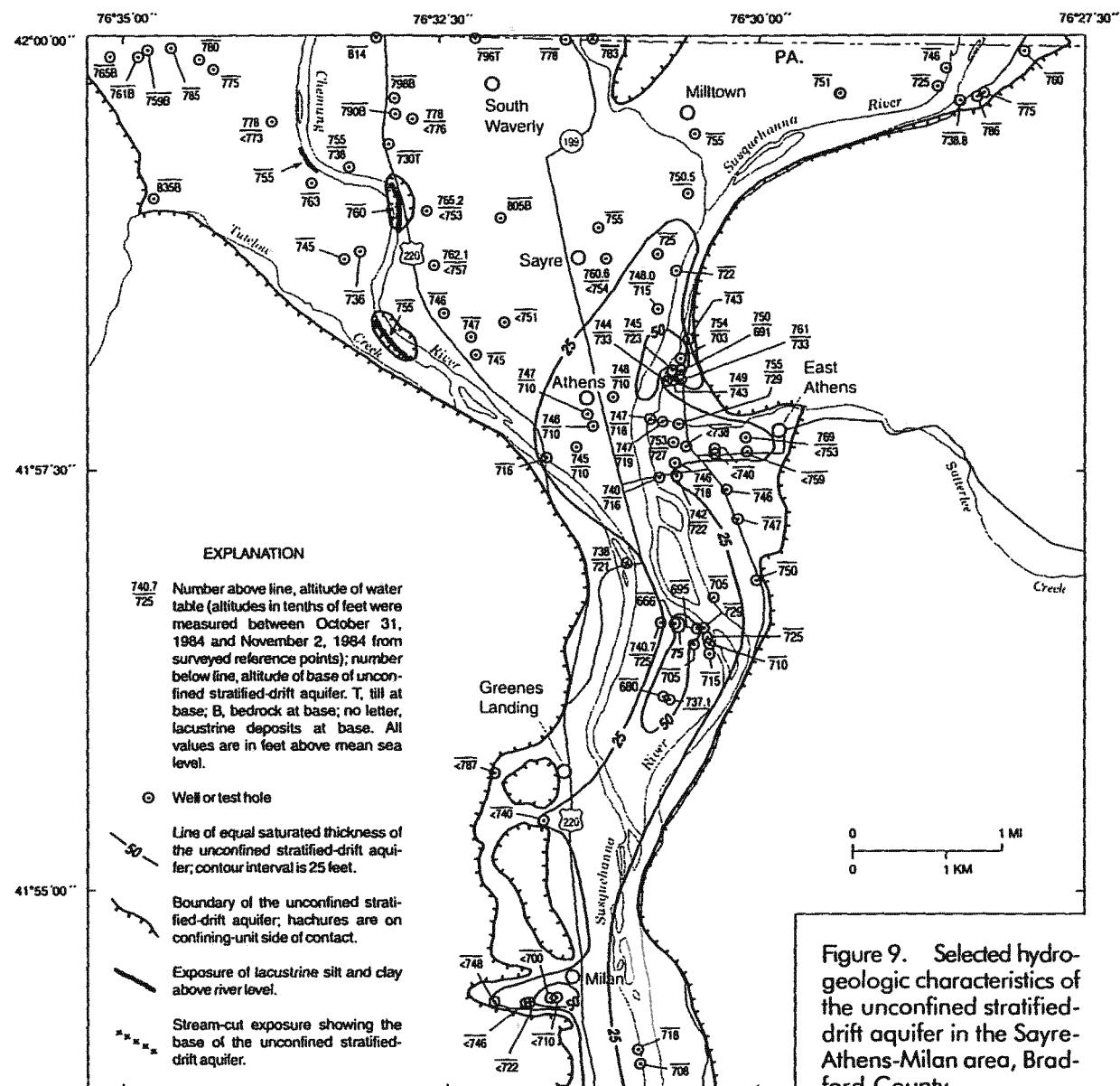
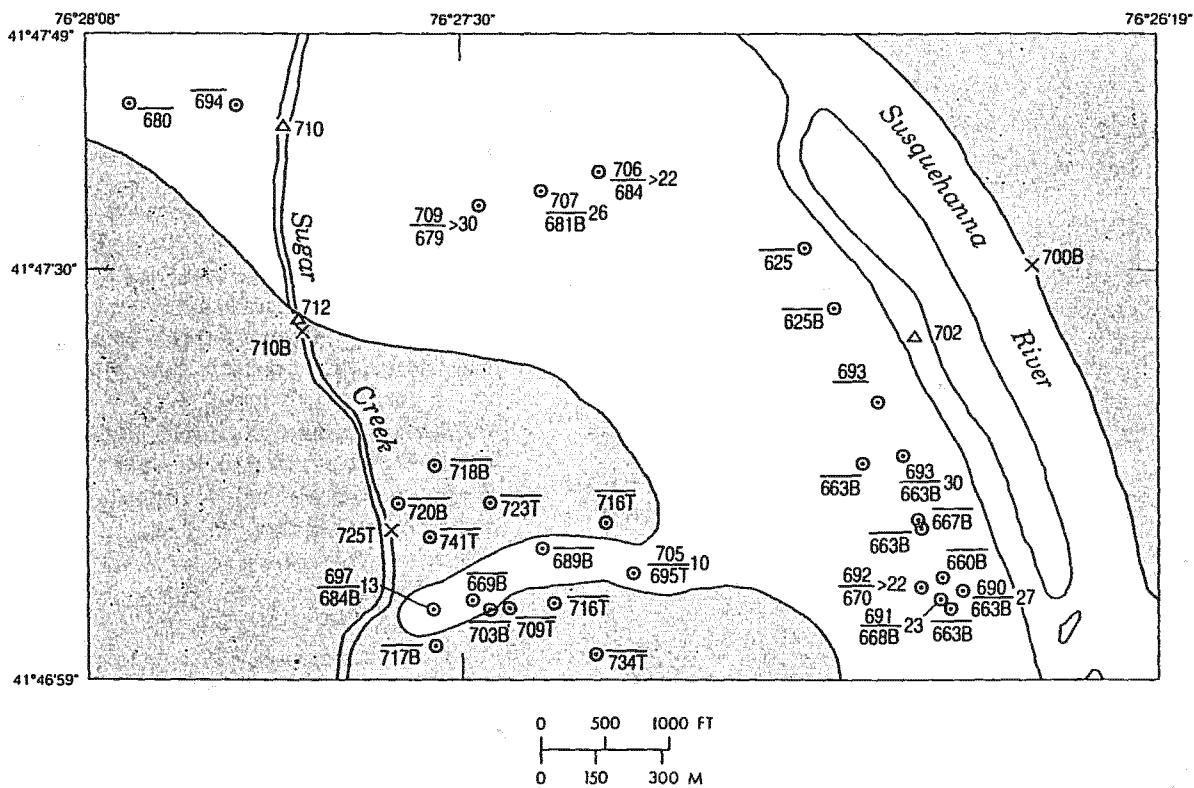


Figure 9. Selected hydrogeologic characteristics of the unconfined stratified-drift aquifer in the Sayre-Athens-Milan area, Bradford County.

the main stream exists along the valley wall. The average recharge rate from these upland areas is estimated to be about 1 (Mgal/d)/mi<sup>2</sup> of bordering upland.

Tributary streams that drain adjacent uplands typically lose water to the underlying aquifer as they flow across their alluvial fans and into the major valleys. The amount of recharge from tributary-

stream infiltration is largely dependent on the amount of upland streamflow available for infiltration and the ability of the streambed and underlying aquifer to transmit the water away from the stream. Randall (1978) estimated that the potential infiltration rate from tributary streams in the Susquehanna River basin in New York was 650 (gal/d)/ft (gallons per day per foot) of stream reach. He rec-



## EXPLANATION

- Area underlain by stratified drift where it is an aquifer
- Area underlain by till, bedrock, or stratified drift where it is not an aquifer
- 705 10** Well or test hole  
Number above line, altitude of water table in June 1984; number below line, altitude of base of stratified drift; number at right of line, saturated thickness of stratified drift. T, till at base; B, bedrock at base; no letter, till or bedrock not penetrated. All values are in feet above mean sea level.
- 702** Surface-water-measurement site  
Number is water-surface altitude in feet above mean sea level.
- 700B** Till or bedrock exposure  
Number is altitude in feet above mean sea level.  
T, till exposure; B, bedrock exposure.

Figure 10. Selected hydrogeologic characteristics of the unconfined stratified-drift aquifer in the North Towanda area, Bradford County.

ognized that the upper stream reach had a lower infiltration rate than the lower stream reach, and determined that infiltration rates are controlled primarily by the permeability and thickness of the aquifer materials near and beneath the stream. Investigation of streambed infiltration for 13 tributary streams in the study area provided similar results (Table 1). The locations of the upstream flow-

measurement sites at the valley walls for the investigated tributary streams are shown on Plates 1A and 1B. The data from the tributary stream measurement sites are presented in Table 2. The infiltration rate of the losing reaches of tributary streams ranged from 19 to 1,700 (gal/d)/ft of reach and averaged 590 (gal/d)/ft of reach. The highest infiltration rates were measured along stream reaches

Table 1. Infiltration Along Selected Tributary Streams

Map-location number of tributary stream <sup>1</sup>	Tributary name	Number of measurements	Average rate of infiltration <sup>2</sup> ([gal/d]/ft of stream reach)
1	Tutelow Creek	1	71
	Upper reach	1	-17
	Lower reach	1	250
2	Satterlee Creek	1	1,700
3	Wolcott Creek	1	620
4	Deer Lick Creek		
	Upper reach	1	110
	Lower reach	2	720
5	Sugar Creek	1	180
6	Lanning Creek	2	700
7	Mitchell Creek	2	280
	Upper reach	3	89
	Lower reach	2	720
8	Holden Creek	3	120
9	Heise Run	4	-6
10	Canada Run	4	830
11	Dantz Run	4	630
12	Straight Run	6	980
	Upper reach	9	180
	Lower reach	9	1,400
13	Asaph Run	10	950
	Upper reach	12	19
	Lower reach	12	1,200

<sup>1</sup>Locations of stream measurement sites near valley walls are shown on Plates 1A and 1B.

<sup>2</sup>Average rate of infiltration is calculated by [(discharge upstream) - (discharge downstream)] / [(distance upstream) - (distance downstream)]. Positive number indicates streamflow loss; negative number indicates streamflow gain.

underlain by significant unconfined aquifers—Satterlee Creek in the Susquehanna River valley at East Athens, and Straight and Asaph Runs in Marsh Creek valley at Asaph (Figure 9 and hydrogeologic section O-O' on Plate 1A, respectively). The lowest infiltration rates were measured along the upper reach of Tutelow Creek in the Susquehanna River valley near Sayre and along Heise Run in Marsh Creek valley near Asaph. The upper reach of Tutelow Creek gains water from the uplands as it flows along the valley wall. This tributary stream does not begin to lose water until it flows away from the valley wall and across the alluvial fan in the lower reach. Heise Run is underlain by relatively fine-grained deposits that restrict groundwater flow away

from the stream, thus accounting for the lack of stream loss.

The potential recharge rate along the tributary is reached when upland streamflow equals or exceeds the potential infiltration rate. When upland streamflow is less than the potential recharge rate, all the streamflow infiltrates and the recharge rate is equal to the streamflow. MacNish and Randall (1982) developed an average streamflow duration curve for bedrock and till upland areas in the Susquehanna River basin of New York from data presented in Ku and others (1975). The streamflow duration curve (Figure 11) expresses the frequency distribution of streamflow per unit area of upland and is based on an annual precipitation of 36 inches (A. D. Randall, written communication, 1991).

Tributary-stream infiltration can be a major source of recharge to the stratified-drift aquifers. For example, a typical tributary stream having an infiltration reach of 1,500 feet would have an average potential recharge rate of 0.9 Mgal/d (million gallons per day). The infiltration for tributary streams having upland drainage basins of 1 to 5 mi<sup>2</sup> would be at the potential rate more than 20 to 50 percent of the time, respectively. A detailed investigation of tributary-stream infiltration along a 3.6-mile reach of Marsh Creek valley in Tioga County indicated that infiltration from four tributaries accounted for more than 70 percent of the recharge to the aquifer (Morrissey and others, 1988; Williams, 1991; Williams and Morrissey, 1996).

Recharge to confined stratified-drift aquifers occurs primarily near the valley walls where surficial sand and gravel is in hydraulic connection with a buried aquifer (Figure 8). These recharge areas are located where ice-contact deposits are exposed at the land surface or where surficial outwash and alluvium directly overlie ice-contact deposits.

Most groundwater flows through the unconfined aquifers toward points of discharge, generally either the main stream draining the valley or swampy areas (Figure 8). Swamps are typically areas of high evapotranspiration losses. Groundwater in the confined aquifers generally flows to-

Table 2. Infiltration Data for Selected Tributary Streams

Map location number of tributary stream <sup>1</sup>	Tributary name	Date of measurement	Measurement of stream discharge at valley wall <sup>2</sup> (ft <sup>3</sup> /s)	Additional measurement		Additional measurement		Additional measurement		Additional measurement		Distance to stream dryness <sup>5</sup> (feet)
				Distance from valley wall <sup>3</sup> (feet)	Stream discharge <sup>4</sup> (ft <sup>3</sup> /s)	Distance from valley wall <sup>3</sup> (feet)	Stream discharge <sup>4</sup> (ft <sup>3</sup> /s)	Distance from valley wall <sup>3</sup> (feet)	Stream discharge <sup>4</sup> (ft <sup>3</sup> /s)	Distance from valley wall <sup>3</sup> (feet)	Stream discharge <sup>4</sup> (ft <sup>3</sup> /s)	
1	Tutelow Creek	6/28/84	0.43	2,600	0.50	—	—	—	—	—	—	3,900
2	Satterlee Creek	7/11/84	7.36	—	—	—	—	—	—	—	—	2,800
3	Wolcott Creek	7/11/84	2.03	—	—	—	—	—	—	—	—	2,100
4	Deer Lick Creek	7/18/84	.24	—	—	—	—	—	—	—	—	1,380
5	Sugar Creek	9/ 1/83	6.22	3,100	.35	—	—	—	—	—	—	N
6	Lanning Creek	8/15/83	.25	—	—	—	—	—	—	—	—	800
		6/27/84	4.49	800	.06	7,400	3.90	—	—	—	—	N
7	Mitchell Creek	8/17/83	.37	1,200	.26	—	—	—	—	—	—	1,700
		6/27/84	1.47	1,900	.28	2,900	.38	—	—	—	—	3,100
		7/26/85	.99	1,900	.81	—	—	—	—	—	—	2,600
8	Holden Creek	8/17/83	.31	1,800	.18	—	—	—	—	—	—	2,200
		6/28/84	5.53	1,800	.25	—	—	—	—	—	—	N
		7/26/85	.58	1,800	.17	—	—	—	—	—	—	2,150
9	Heise Run	7/18/83	.25	1,145	.22	—	—	—	—	—	—	N
		6/20/84	.73	1,145	.65	—	—	—	—	—	—	N
		7/19/84	.28	1,145	.33	—	—	—	—	—	—	N
		7/26/85	.15	1,145	.25	—	—	—	—	—	—	N
10	Canada Run	7/12/84	7.38	1,050	.93	—	—	—	—	—	—	N
		7/17/84	2.87	1,050	.42	1,495	.16	—	—	—	—	1,645
		7/24/84	1.28	1,050	.17	—	—	—	—	—	—	1,200
		7/26/84	.91	—	—	—	—	—	—	—	—	900
11	Dantz Run	7/19/83	.71	—	—	—	—	—	—	—	—	780
		5/17/84	5.78	—	—	725	5.26	—	—	—	—	N
		6/20/84	3.40	—	—	725	2.27	—	—	—	—	N
		7/18/84	1.44	350	.35	725	.46	—	—	—	—	1,145
		7/26/85	.74	—	—	—	—	—	—	—	—	735
12	Straight Run	7/19/83	1.64	—	—	—	—	—	—	—	3,705	2,500
		6/28/84	13.3	—	—	1,775	12.2	—	—	—	8.59	N
		10/ 5/84	.89	840	.08	1,775	.52	—	—	—	—	2,355
		12/18/84	22.4	840	.6	1,775	20.9	2,570	18.5	3,705	16.2	N
		2/27/85	32.8	840	.9	1,775	34.4	2,570	31.3	3,705	24.8	N
		3/27/85	19.8	840	—	1,775	18.4	2,570	15.0	3,705	13.0	N
		4/24/85	5.26	840	.02	1,775	4.65	2,570	3.29	3,705	1.05	N
		5/30/85	3.07	—	—	—	—	2,570	.04	—	—	3,040
		7/23/85	1.11	840	1.21	1,775	.79	—	—	—	—	2,355
		8/19/85	.81	840	—	—	—	—	—	—	—	2,330
		9/ 4/85	1.08	840	1.20	1,775	.76	—	—	—	—	2,340
		10/23/85	.74	840	.70	1,775	.37	—	—	—	—	2,180

Table 2. (Continued)

Map location number of tributary stream <sup>1</sup>	Tributary name	Date of measurement	Measurement of stream discharge at valley wall <sup>2</sup> (ft <sup>3</sup> /s)	Additional measurement		Additional measurement		Additional measurement		Additional measurement		Distance to stream dryness <sup>5</sup> (feet)
				Distance from valley wall <sup>3</sup> (feet)	Stream discharge <sup>4</sup> (ft <sup>3</sup> /s)	Distance from valley wall <sup>3</sup> (feet)	Stream discharge <sup>4</sup> (ft <sup>3</sup> /s)	Distance from valley wall <sup>3</sup> (feet)	Stream discharge <sup>4</sup> (ft <sup>3</sup> /s)	Distance from valley wall <sup>3</sup> (feet)	Stream discharge <sup>4</sup> (ft <sup>3</sup> /s)	
13	Asaph Run	7/20/83	3.53	—	—	—	—	—	—	—	—	2,200
		6/28/84	28.3	600	27.7	1,490	25.3	2,590	23.9	—	—	N
		10/ 5/84	2.51	600	1.66	1,490	.44	—	—	—	—	2,250
		12/18/84	39.7	600	43.6	1,490	38.6	2,590	38.0	—	—	N
		2/27/85	73.8	600	79.2	1,490	74.7	2,590	67.5	—	—	N
		3/27/85	41.3	600	41.9	1,490	35.9	2,590	36.6	—	—	N
		4/24/85	13.4	600	10.8	1,490	9.38	2,590	8.67	—	—	N
		5/30/85	6.90	600	4.63	1,490	4.21	2,590	2.11	—	—	N
		7/23/85	2.21	600	1.52	1,490	.57	—	—	—	—	2,190
		8/19/85	1.37	—	—	—	—	—	—	—	—	1,465
		9/ 5/85	2.32	600	1.97	1,490	.73	—	—	—	—	2,150
		9/11/85	5.70	600	5.28	1,490	4.00	2,590	1.81	—	—	N
		9/12/85	4.19	600	3.15	1,490	1.89	2,590	.59	—	—	N
		10/23/85	2.04	600	1.18	1,490	.26	—	—	—	—	1,635

<sup>1</sup>Locations of stream measurement sites near the valley walls are shown on Plates 1A and 1B.<sup>2</sup>Stream discharge measured at the most downstream point where the channel was known to be cut in till or bedrock, or was within its own upland valley.<sup>3</sup>Distance from stream discharge measurement site at valley wall downstream to each additional measurement site along the stream.<sup>4</sup>Discharge at stream discharge measurement site.<sup>5</sup>Distance from stream measurement site at valley wall downstream to point of stream dryness; N indicates stream flowed to main stream.

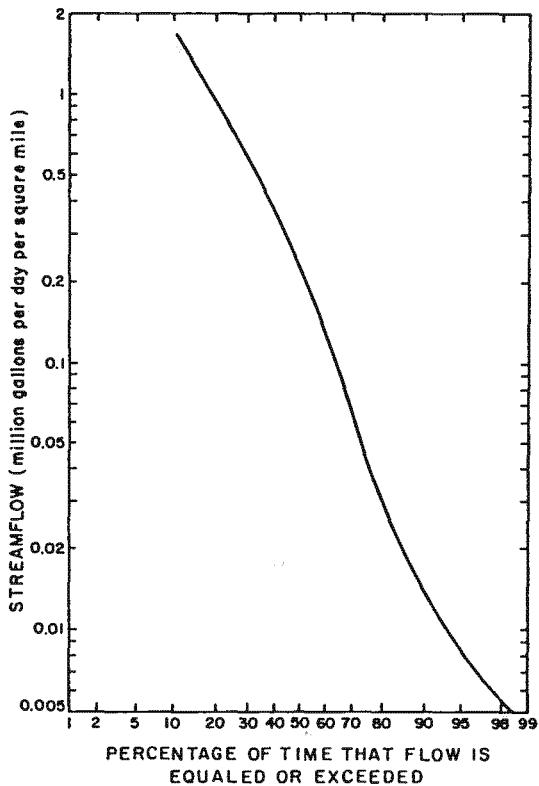


Figure 11. Average streamflow duration for streams draining bedrock and till uplands in the Susquehanna River basin, New York.

ward the center of the valley and discharges in part by upward leakage through the lacustrine confining unit or by direct (lateral) flow to the unconfined aquifers where the confining unit is absent.

Groundwater withdrawals may significantly alter the natural groundwater system. Pumpage from unconfined aquifers captures groundwater that otherwise would have discharged to a surface-water body. Large groundwater withdrawals from unconfined aquifers near streams, swamps, or other surface-water bodies can cause substantial amounts of induced infiltration where the aquifer is in good hydraulic connection with surface water (Figure 8).

By numerical simulation, Morrissey (1987) determined sources of recharge to a hypothetical well located 200 feet from a river in an unconfined stratified-drift aquifer having hydrologic characteristics

and conditions typical of the glaciated northeast (Figure 12). In this simulation model, induced infiltration accounted for more than 50 percent of the recharge at pumping rates greater than 1.7 Mgal/d. The actual amount of induced infiltration at a site would vary depending on aquifer and stream geometry, hydrologic characteristics and conditions, and well location. Yager (1986) estimated by numerical simulation that 58 percent of the 1.1 Mgal/d pumped from the Kirkwood well field (located 100 feet from the Susquehanna River in south-central New York) during low-recharge conditions was induced infiltration.

## WATER-LEVEL FLUCTUATIONS

Groundwater levels fluctuate in response to variations in recharge, natural discharge, and pumpage from the aquifers. The hydrograph of average monthly water levels in well Ti-1 is based on 50 years of record, and shows typical seasonal trends (Figure 13). Well Ti-1 is 23 feet deep and was completed in an unconfined stratified-drift aquifer in the Pine Creek valley at Gaines, Tioga County. Groundwater levels are usually at their lowest in late summer and early fall. In late fall and early winter, water levels normally rise as recharge increases because of the decrease in evapotranspiration losses at the end of the growing season. Water levels generally stabilize or decline slightly during the winter freeze when the available recharge becomes smaller, and then rise sharply during the spring thaw when recharge increases from infiltration of rain and snowmelt. In late spring, water levels decline as recharge decreases because of increased evapotranspiration at the start of the growing season. Although thunderstorms and showers locally cause intermittent periods of recharge, water levels commonly continue to decline throughout the summer, reaching the lowest levels in late summer and early fall.

Figure 14 shows a 50-year (1935-85) hydrograph of average water levels in well Ti-1 for August, September, and October. Droughts and associated water-supply problems typically become most severe during this annual low-water period. The hydrograph indicates no long-term decline in

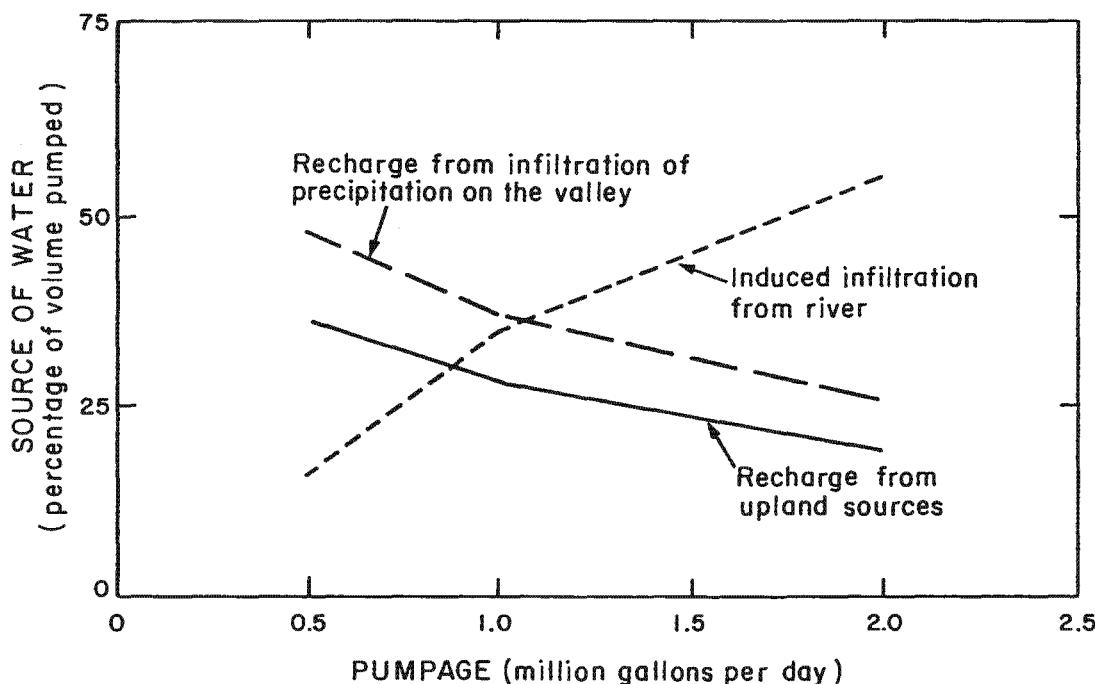


Figure 12. Relations between sources of recharge and pumpage for a hypothetical well in an unconfined stratified-drift aquifer (modified from Morrissey, 1987).

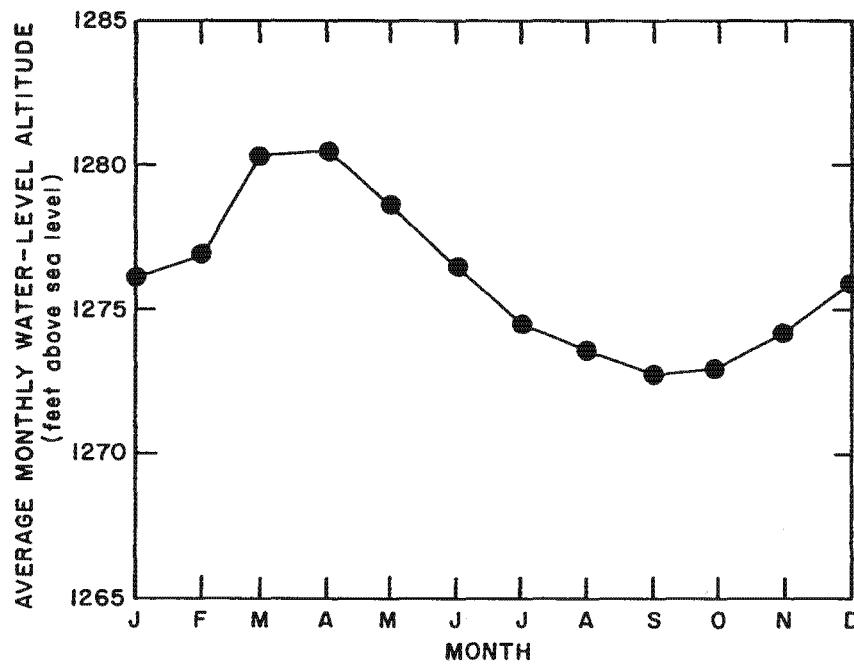


Figure 13. Average monthly water levels for well Ti-1 at Gaines, Tioga County, 1935–85.

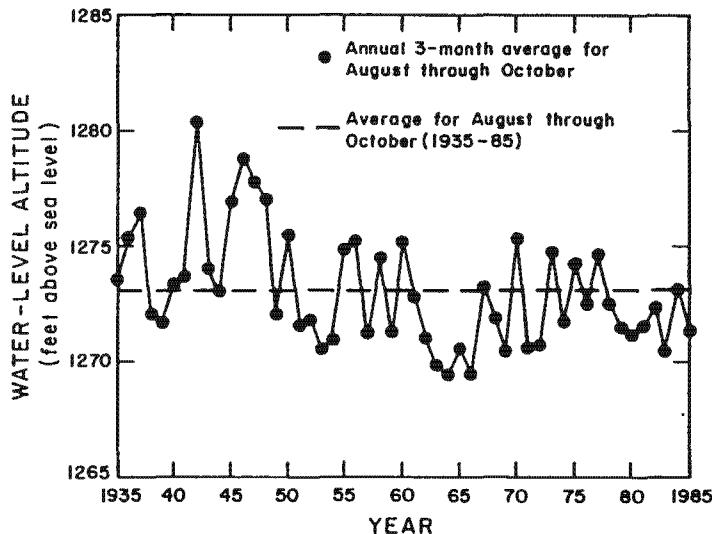


Figure 14. Annual 3-month average water levels (August through October) for well Ti-1 at Gaines, Tioga County, 1935-85.

water levels but, rather, somewhat cyclical periods of low and high water levels. The effects of the drought of the early to mid-1960's are clearly shown. Also, the water levels from 1978 to 1985 were mostly below the 50-year average.

Pumping locally can affect groundwater levels, as shown in the hydrograph of well Br-464 (Figure 15). Well Br-464 is an abandoned production well at the well field of GTE Sylvania in North Towanda. The water level in the well is affected by

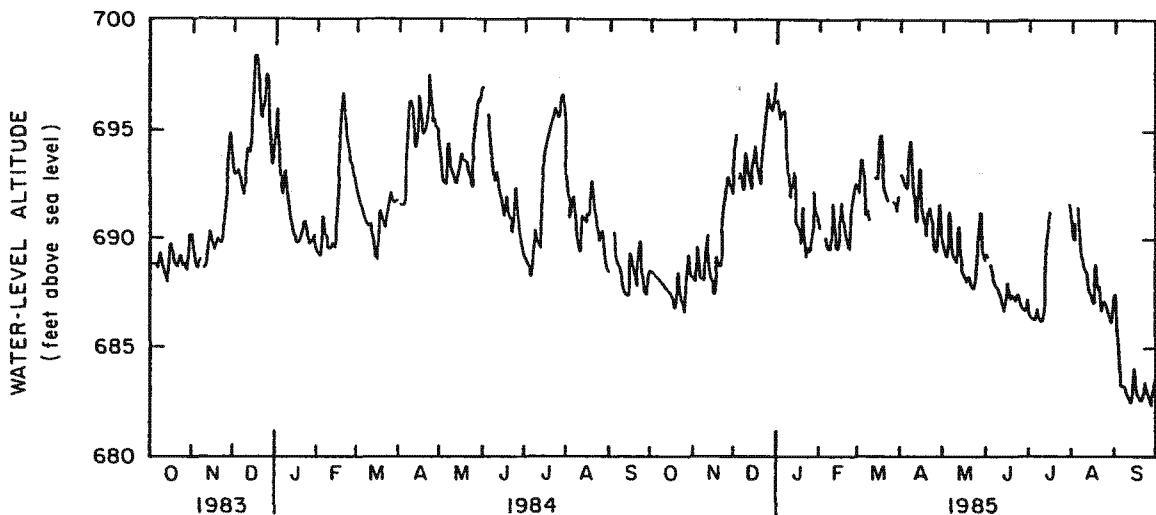


Figure 15. Water levels in well Br-464 at the GTE Sylvania well field at North Towanda, Bradford County, October 1983 through September 1985.

pumping at the well field. The hydrograph shows water-level rises during early July in 1984 and 1985, normally a time of decline, caused by decreased pumping associated with plant shutdown during this time.

### GROUNDWATER USE

Groundwater is pumped for domestic, public, industrial, institutional, and agricultural uses from drilled, driven, and dug wells in the study area. Figure 16 shows three types of finishes for drilled wells; these finishes are screened, open-end, and open-hole. Domestic and nondomestic wells tapping water-bearing fractures in bedrock typically are open-hole wells. Domestic wells tapping stratified drift or till typically are finished with open-ended casing in the water-bearing zone. Nondomestic wells completed in stratified drift and constructed for higher yields are screened in the water-bearing zone. Completion data for selected wells are presented in Table 21.

Table 3 presents annual pumpage information for 1983 and 1985 for selected municipal, industrial, institutional, and agricultural users of groundwater in the study area (Pennsylvania Department of Environmental Resources, Bureau of Water Re-

sources Management, State Water Plan Division, Harrisburg, Pa., written communication, 1986). In 1983, these groundwater users pumped 8.3 Mgal/d, and in 1985, they pumped 10.8 Mgal/d. Thirteen of the 25 users tapped unconfined stratified-drift aquifers; 4 tapped confined stratified-drift aquifers; 1 tapped bedrock and unconfined stratified-drift aquifers; 2 tapped bedrock and confined stratified-drift aquifers; and 5 tapped bedrock aquifers. In 1983, more than 60 percent of the 8.3 Mgal/d was obtained from the well fields of GTE Sylvania at North Towanda and Sayre Water Company at Tioga Point (both of which tap unconfined stratified-drift aquifers that are partly recharged by induced infiltration from the Susquehanna River). In 1985, the well fields of GTE Sylvania, Sayre Water Company, and the U.S. Fish and Wildlife Service at Asaph (which taps an unconfined stratified-drift aquifer that is recharged by tributary-stream infiltration) accounted for 75 percent of the 10.8 Mgal/d.

Figures 17 and 18 show monthly pumpage by GTE Sylvania from 1980 through 1985 and by the U.S. Fish and Wildlife Service from 1983 through 1985, respectively. Pumpage by GTE Sylvania varied according to demand for processing water at the plant; it ranged from 6.7 Mgal/d in April, Oc-

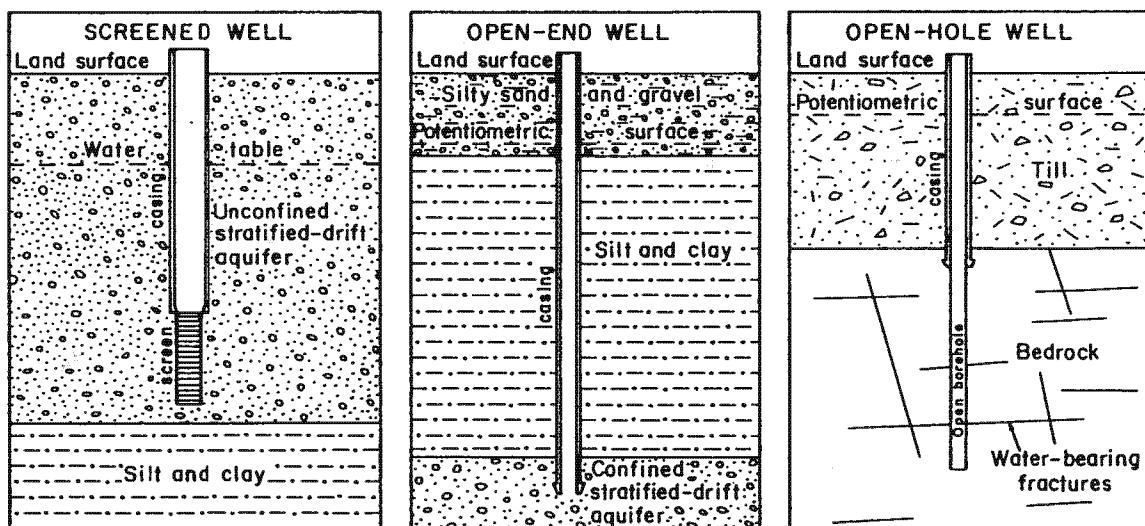


Figure 16. Types of finish for drilled wells.

Table 3. Selected Municipal, Industrial, Institutional, and Agricultural Users of Groundwater

Groundwater user	Production well(s)	Estimated annual pumpage rate (Mgal/d) <sup>1</sup>			Aquifer <sup>2</sup>
		1983	1985		
<b>BRADFORD COUNTY</b>					
Bradford County Home	109	0.021	0.019	—	Qsd/c
Canton Borough Authority	124	.27	.26	—	Qsd/c
Dupont and Co.	100	.12	.12	—	Qsd/u
GTE Sylvania	458-460, 464-468	3.4	4.7	—	Qsd/u
Ingersoll-Rand Co.	108, 221	.29	.21	—	Qsd/u
J. Johnson	761	.2	.2	—	Qsd/u
Masonite Corp.	489, 90, 455, 457	.37	.38	—	Qsd/u
New Albany Water Fund	121	.008	—	—	Dck
Sayre Water Co.	226, 227	1.7	1.6	—	Qsd/u
Taylor Packing Co.	831-833	.090	.088	—	Dck
Towanda Municipal Authority	372, 373	.49	.52	—	Qsd/u
Troy Borough	115, 265, 266	.052	.21	—	Dck, Qsd/u
Wells Mills Co.	5112, 808	.006	.006	—	Dck, Qsd/c
Wyalusing Borough	111	.032	.066	—	Dck
<b>POTTER COUNTY</b>					
Shinglehouse Borough Water Department	282	.34	.12	—	Qsd/u
Lewisville Water Co.	39, 281	.028	.048	—	Dck
<b>TIOGA COUNTY</b>					
Dresser Industries	398	.060	.060	—	Qsd/u
Elkland Borough Water Department	153	.19	.17	—	Qsd/c
Knoxville Borough Water Department	212	.023	.023	—	Dlh
Lawrenceville Water Authority	214, 215	.032	.032	—	Qsd/u
Nelson Municipal Water	522	.017	.012	—	Qsd/c
Osceola Water Association	12, 213	.027	.023	—	Dlh, Qsd/c
Tioga Borough Water Works	146	.052	.046	—	Qsd/u
U.S. Fish and Wildlife Service	269, 271, 272	.34	1.8	—	Qsd/u
Westfield Borough Water Works	537	.18	.091	—	Qsd/u
Total		8.3	10.8	—	—

<sup>1</sup>From Pennsylvania Department of Environmental Resources, Bureau of Water Resources Management, State Water Plan Division, Harrisburg, Pa. (written communication, 1986).

<sup>2</sup>Qsd/u, stratified drift/unconfined; Qsd/c, stratified drift/confined; Dck, Catskill Formation; Dlh, Lock Haven Formation.

<sup>3</sup>Pumpage is about 1.1 Mgal/d during dry weather only.

<sup>4</sup>Well Br-455 replaced well Br-457 in November 1984.

<sup>5</sup>Well Br-808 replaced well Br-112 in November 1985.

tober, and November 1980 to 1.8 Mgal/d in July 1982. Pumpage by the U.S. Fish and Wildlife Service increased from a low of 0.34 Mgal/d during most of 1983 to a high of 2.7 Mgal/d in December 1985. The increased pumpage was the result of an increase in demand for water in fish raceways at the research facility.

## WELL YIELD

The water-yielding capabilities of the aquifers were determined from reported-yield and specific-capacity data from more than 500 domestic and nondomestic wells. Reported yields for selected wells are presented in Table 21. Following the com-

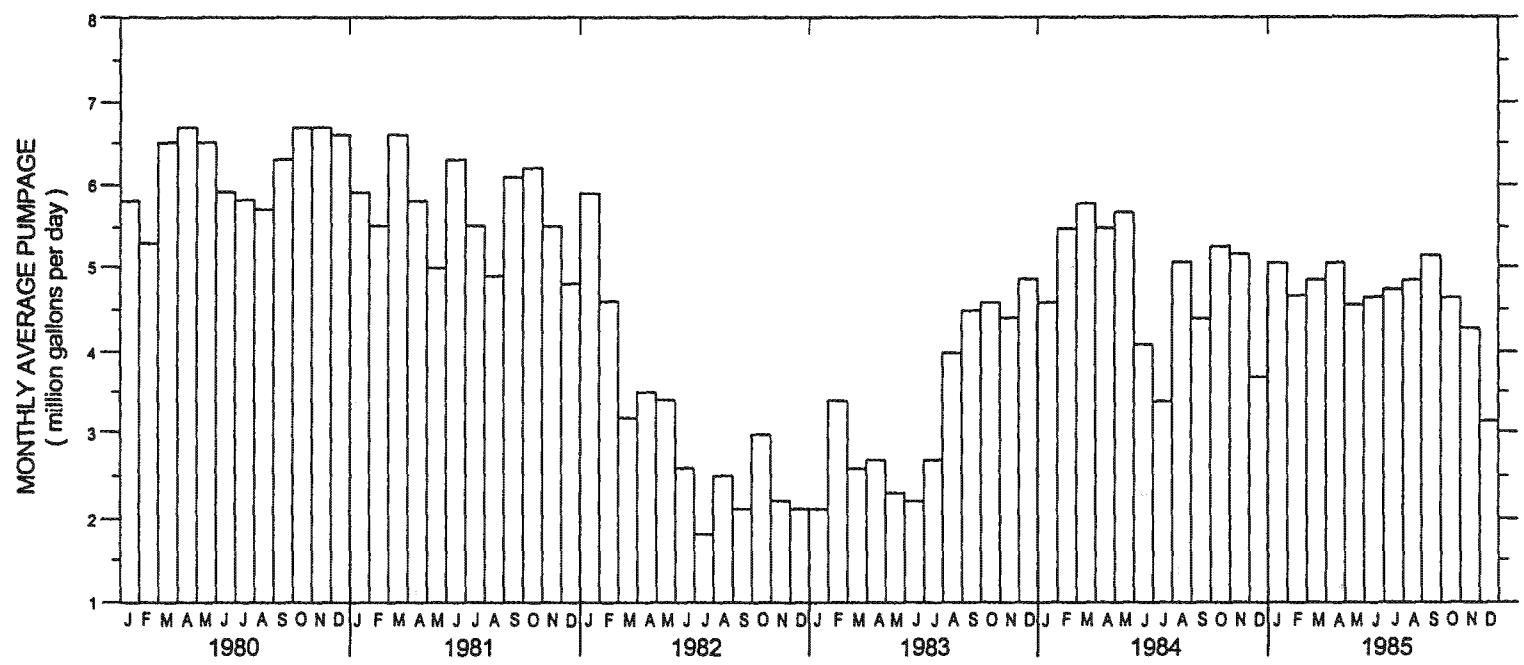


Figure 17. Monthly average pumpage at the GTE Sylvania well field at North Towanda, Bradford County, 1980-85.

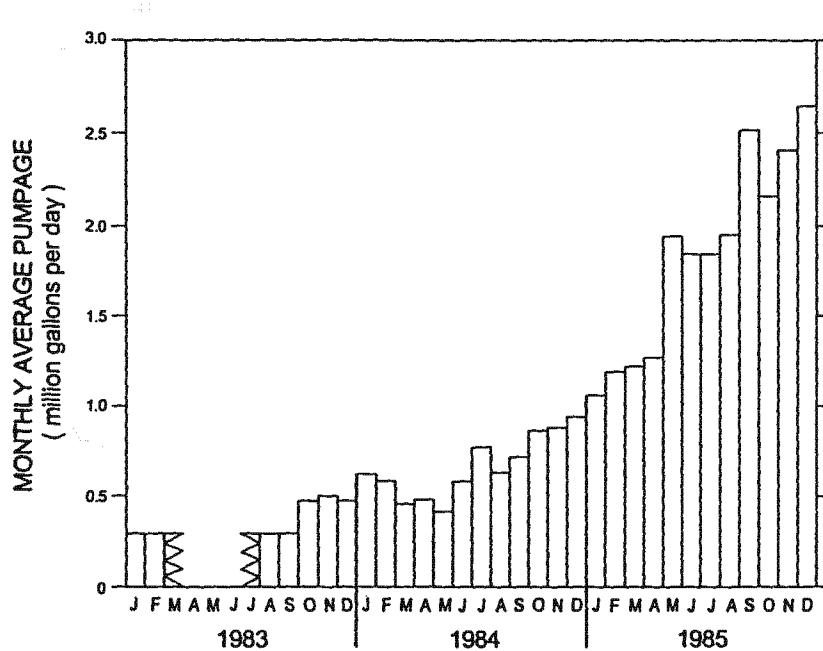


Figure 18. Monthly average pumpage at the U.S. Fish and Wildlife Service well field near Asaph, Tioga County, 1983–85.

pletion of a well drilled for domestic water supply, drillers typically determine the yield of the well by bailing the well (if the well was drilled by the cable-tool method) or by blowing air through the drill stem and forcing water out of the well (if the well was drilled by the air-rotary method). Reported yields of domestic wells from drillers' acceptance tests generally are underestimates of the potential yield of high-yield aquifers because (1) drilling commonly is stopped after an adequate yield is obtained (5 to 10 gal/min [gallons per minute] for domestic supply); (2) domestic wells are not constructed for high yields (screens are not used); (3) yield estimates from bailing are limited by how fast the driller can remove the well water; and (4) some of the water blown by the air-rotary method may be forced back into the aquifer rather than pushed to the surface. Reported yields determined by drillers are commonly overestimates of the potential yield of low-yield aquifers because tests typically are less than one hour in length and may be affected by well-bore storage, and drillers rarely report yields of less than 3 gal/min (minimal yield required for

a domestic supply). However, analysis of reported yields of domestic supplies is useful in determining the relative water-yielding capabilities of the aquifers. A summary of reported yields of domestic wells is presented in Table 4. In general, stratified-drift aquifers have the highest domestic-well yields and bedrock aquifers have the lowest. Yields of most domestic wells completed in till are less than those completed in stratified drift but greater than those completed in bedrock. Most domestic-well yields are greater in the Catskill Formation than in the Lock Haven Formation. In general, the coarser grained Catskill Formation probably has larger, deeper, and more open fractures than does the Lock Haven Formation.

A more accurate measure of the water-yielding capabilities of the aquifers is obtained by a specific-capacity test. Many high-capacity wells completed for municipal, industrial, or other non-domestic use are tested for yield and drawdown through the use of a submersible pump. Specific capacity is the discharge rate divided by drawdown (pumping water level at the end of the test minus

Table 4. Summary of Reported Yields of Domestic Wells

Aquifer	Number of wells	Median well depth (feet below land surface)	Reported yield (gal/min)		
			75 percent <sup>1</sup>	50 percent <sup>1</sup> (median)	25 percent <sup>1</sup>
Stratified drift	219	60	12	20	25
Unconfined	159	50	12	20	25
Confined	60	87	12	20	25
Till	55	75	10	15	23
Bedrock	239	154	6	10	20
Huntley Mountain Formation	7	135	—	20	—
Chadakoin Formation	2	165	—	35	—
Catskill Formation	90	113	6	12	23
Lock Haven Formation	140	150	6	10	15

<sup>1</sup>Percentage of wells in which indicated yield is equaled or exceeded.

static water level) in the pumped well. Most non-domestic wells are constructed to maximize well yield (drilled deep enough to penetrate a substantial thickness of the aquifer; completed in the more permeable zones of the aquifer; and, if tapping stratified drift, screened). Commonly, a number of exploratory test holes are drilled and only at the most promising sites are wells constructed and specific-capacity tests completed. Specific-capacity data for 95 wells are presented in Table 5. The specific-capacity tests were completed by drillers, consultants, and U.S. Geological Survey and Pennsylvania Bureau of Topographic and Geologic Survey personnel. The specific-capacity tests ranged in length from 0.3 hours to virtually continuous operation. A majority of the wells were pumped for 15 hours or more, and discharge rates ranged from 5 to more than 1,500 gal/min. Most wells completed in stratified-drift aquifers have specific capacities an order of magnitude greater than those completed in till or bedrock (Table 6). Specific capacities of greater than 100 (gal/min)/ft (gallons per minute per foot) of drawdown were calculated for wells completed in selected unconfined stratified-drift aquifers that are in good hydraulic connection with surface water. Although the number of tests was limited, most wells in the Catskill Formation have specific capacities greater than those in the Lock Haven Formation.

Table 7 presents a summary of specific capacity and calculated yield of wells completed in stratified drift at selected valley locations. The

yields were calculated by multiplying the median specific capacity by one half of the median available drawdown. The 50 percent reduction in available drawdown was used to account for well losses and the decrease in specific capacity that occurs with increasing time and pumping rate. Median specific capacities of wells tapping unconfined aquifers range from 2.5 to 390 (gal/min)/ft. The highest specific capacities and calculated well yields for unconfined aquifers in the study area are in the Susquehanna River valley at East Athens-Tioga Point, Bradford County; the lowest are for aquifers in the Cowanesque River valley at Lawrenceville, Tioga County. Median specific capacities of wells that are completed in confined aquifers range from 11 to 16 (gal/min)/ft. The highest specific capacities and calculated well yields for confined aquifers in the study area are for the Marsh Creek valley at Wellsboro Junction, Tioga County.

## GROUNDWATER QUALITY

The quality of groundwater from the aquifers in the study area was characterized by field and laboratory analyses of samples from more than 200 wells. The results of the field measurements for specific conductance and hardness are presented in Table 21. The results of the laboratory analyses for total dissolved solids, alkalinity, major cations and anions, nitrate, and selected major and trace metals, are presented in Table 20, and the re-

Table 5. Specific Capacity of Pump-Tested Wells

Well number	Discharge (gal/min)	Length of test (hours) <sup>1</sup>	Specific capacity ([gal/min]/ft)	Available drawdown (feet) <sup>2</sup>	Aquifer <sup>3</sup>
BRADFORD COUNTY					
Br- 7	38	12	0.38	16	Dlh
9	350	24	44	34	Qsd/u
92	11	1	.72	47	Dlh
98	40	22	15	12	Qsd/u
100	200	24	27	43	Qsd/u
102	250	21	45	16	Qsd/u
202	13	12	.25	131	Dlh
226	1,680	50	420	70	Qsd/u
227	950	24	870	27	Qsd/u
372	410	51	48	27	Qsd/u
373	320	51	20	28	Qsd/u
374	100	5	20	20	Qsd/u
375	120	48	20	20	Qsd/u
457	275	72	21	30	Qsd/u
460	800	24	67	30	Qsd/u
462	460	72	19	32	Qsd/u
463	800	23	270	30	Qsd/u
464	980	22	330	20	Qsd/u
465	1,000	22	210	31	Qsd/u
466	1,000	8.5	140	29	Qsd/u
467	1,000	24	250	31	Qsd/u
541	200	24	83	19	Qsd/u
551	30	3	.80	—	Dlh
768	22	1	6.0	85	Qsd/c
786	45	4	360	26	Qsd/u
787	45	4	5.0	22	Qsd/u
796	65	4	390	55	Qsd/u
801	6	.5	.19	120	Qt
807	75	3	7.5	41	Qsd/u
808	75	46	13	74	Qsd/c
809	24	1	27	40	Qsd/u
810	30	.5	38	73	Qsd/c
818	70	3	.88	61	Dlh
826	40	3.5	2.2	33	Qsd/u
829	100	40	25	45	Qsd/u
833	40	3	11	—	Dck
POTTER COUNTY					
Po- 39	40	7.0	10	26	Dck
76	205	60	1.7	—	Dck
183	40	24	10	125	Dlh
283	300	26	9.1	100	Qsd/u
285	200	NR	50	100	Qsd/u
TIOGA COUNTY					
Ti- 4	10	12	.08	110	Dck
5	45	.5	15	95	Qsd/c
6	400	64	11	85	Qsd/c
7	125	48	23	70	Qsd/c
16	25	C	13	80	Qsd/c
32	6	NR	.50	88	Dlh
43	120	C	3.8	40	Qsd/u
47	25	9	.19	20	Dlh

Table 5. (Continued)

Well number	Discharge (gal/min)	Length of test (hours) <sup>1</sup>	Specific capacity ([gal/min]/ft)	Available drawdown (feet) <sup>2</sup>	Aquifer <sup>3</sup>
TIoga County (continued)					
Ti- 56	26	1	21	120	Qsd/c
61	350	20	23	49	Qsd/u
62	200	C	10	53	Qsd/u
66	80	C	3.2	74	Qsd/u
144	485	NR	35	71	Qsd/c
151	210	NR	5.2	85	Qsd/c
152	130	NR	1.4	100	Qsd/c
153	530	48	28	50	Qsd/c
162	5	18	.30	—	Dck
191	32	5	21	50	Qsd/u
214	130	72	18	20	Qsd/u
215	135	72	19	20	Qsd/u
216	26	1	100	86	Qsd/c
218	490	23	14	—	Dlh
221	12	1	25	110	Qsd/u
222	250	2	40	110	Qsd/u
269	1,000	24	36	90	Qsd/u
270	200	24	20	85	Qsd/u
271	1,000	24	29	80	Qsd/u
272	1,000	24	27	80	Qsd/u
294	5	4	.06	57	Dlh
441	50	5	13	31	Dlh
464	12	1	38	100	Qsd/u
465	12	1	25	105	Qsd/u
466	12	1	19	95	Qsd/u
467	250	3	34	100	Qsd/u
468	12	1	10	50	Qsd/u
470	20	.3	5.0	65	Qsd/u
471	25	1	17	35	Qsd/u
477	20	24	4.0	30	Qsd/u
487	23	1.5	2.3	20	Qsd/u
490	75	3.5	9.9	20	Qsd/u
491	15	NR	2.5	15	Qsd/u
497	100	15	15	13	Qsd/u
498	22	1	1.9	145	Dlh
511	21	1	11	118	Qsd/c
513	35	1.5	3.9	130	Qsd/c
518	35	24	3.9	60	Qsd/c
522	15	24	.31	58	Qsd/c
523	120	NR	1.3	—	Dlh
524	30	1.7	.76	50	Qt
525	30	1.5	.88	45	Qt
526	70	24	3.3	60	Qt
528	30	48	.33	109	Qsd/c
535	400	64	11	75	Qsd/c
537	585	24	29	75	Qsd/u

<sup>1</sup>NR, not reported; C, reported to be in continuous operation.<sup>2</sup>For the purposes of this table, available drawdown is defined as the distance from the static-water level to the base of the aquifer or bottom of the well for unconfined stratified-drift aquifers and for till; and the distance from the static-water level to the top of the aquifer for confined stratified-drift aquifers and for bedrock. Available drawdown was not used to determine specific capacity.<sup>3</sup>Qsd/u, stratified drift/unconfined; Qsd/c, stratified drift/confined; Qt, till; Dck, Catskill Formation; Dlh, Lock Haven Formation.

Table 6. Summary of Specific Capacity of Pump-Tested Wells

Aquifer	Number of tested wells	Median available drawdown <sup>1</sup> (feet)	Specific capacity ([gal/min]/ft)					
			90 percent <sup>2</sup>	75 percent <sup>2</sup>	50 percent <sup>2</sup> (median)	25 percent <sup>2</sup>	10 percent <sup>2</sup>	Range
Stratified drift	73	50	3.8	10	20	38	200	0.31-870
Unconfined	54	35	4.3	15	24	45	260	2.2-870
Confined	19	85	1.2	4.6	11	22	36	.31-100
Till	4	55	—	—	.82	—	—	.19-3.3
Bedrock	18	59	.16	.32	.84	8.0	12	.06-14
Catskill Formation	5	68	—	—	1.7	—	—	.08-11
Lock Haven Formation	13	59	—	.38	.80	1.9	—	.06-14

<sup>1</sup>For the purposes of this table, available drawdown is defined as the distance from the static-water level to the base of the aquifer or bottom of the well for unconfined stratified-drift aquifers and for till; and the distance from the static-water level to the top of the aquifer for confined stratified-drift aquifers and for bedrock.

<sup>2</sup>Percentage of wells in which indicated specific capacity is equaled or exceeded.

sults for radium are presented in Table 8. The source, significance, and recommended limits of water-quality constituents are presented in Table 9. Median values of specific conductance, hardness, alkalinity, nitrate, major cations and anions, iron, and manganese for the aquifers are presented in Table 10. A summary of water-quality analyses for total dissolved solids is presented in Table 11.

### HYDROGEOCHEMICAL SYSTEM

The hydrogeochemical system in the glaciated valleys of the study area can be divided into two major zones: (1) a zone of unrestricted groundwater flow that contains water of the calcium bicarbonate type; and (2) a zone of restricted groundwater flow that contains water of the sodium chloride type. In most unrestricted groundwater flow zones, calcium is the major cation and bicarbonate is the major anion, and total dissolved solids, alkalinity, and hardness increase with residence time and calcareous content of the aquifer along the groundwater flow path. Unrestricted groundwater flow is found within unconfined and confined stratified-drift aquifers, and in many of the till and shallow bedrock systems.

In the glaciated valleys, circulation of groundwater is controlled partly by low-permeability materials such as fine-grained lacustrine deposits, till, and nonfractured bedrock. Restricted groundwater

circulation is present in bedrock and, in some areas, in till and confined stratified drift that directly overlie bedrock. Water of the sodium chloride type is present at relatively shallow depths in most valleys. Table 12 presents data for inventoried wells drilled for water supply that produce water of the sodium chloride type. The locations of the wells are shown in Figure 19. Almost all of the wells are located in major stream and river valleys. Of the 44 wells, 38 are completed in bedrock (23 wells in the Lock Haven Formation and 15 wells in the Catskill Formation), four wells are completed in confined stratified drift, and two are completed in till. The wells range in depth from 37 to 720 feet and the median depth is 200 feet.

Figure 20 shows specific-conductance logs of wells Ti-498 and Br-557. These wells penetrate highly saline, restricted-flow zones at shallow depths in the Lock Haven Formation. Water-quality analysis of a grab sample from a depth of 150 feet in well Ti-498 is presented in Table 13. The sample, which is probably characteristic of the groundwater from other restricted-flow zones of the region, contains 7,800 mg/L (milligrams per liter) of dissolved solids, of which more than 85 percent is sodium and chloride. The water has elevated concentrations of barium, strontium, and radium and a low concentration of sulfate. Typically, the concentrations of dissolved barium and strontium are controlled by the solubility of the minerals barite ( $BaSO_4$ ) and celestite ( $SrSO_4$ ), respectively (Hem, 1985); radium has chemical properties similar to

Table 7. Summary of Specific Capacity and Calculated Yield of Pump-Tested Wells Completed in Selected Stratified-Drift Aquifers

Area	Number of pump-tested wells	Median available drawdown <sup>1</sup> (feet)	Specific capacity ([gal/min]/ft)		Calculated median well yield (gal/min) <sup>2</sup>
			Median	Range	
<i>Unconfined stratified-drift aquifers</i>					
Susquehanna River valley					
East Athens-Tioga Point	5	27	390	5.0-870	3,000
North Towanda	14	30	56	15-330	840
Other areas	4	25	21	20-27	260
Tioga River valley	4	20	17	3.8-19	170
Cowanesque River valley					
Lawrenceville	3	20	2.5	2.3-9.9	25
Marsh Creek valley					
Asaph	13	90	25	5.0-40	1,100
Oswayo Creek valley					
Shinglehouse	2	100	30	9.1-50	1,500
<i>Confined stratified-drift aquifers</i>					
Susquehanna River valley	3	74	13	6.0-38	480
Cowanesque River valley					
Westfield	5	60	14	3.2-35	420
Elkland	7	85	11	1.4-28	470
Marsh Creek valley					
Wellsboro Junction	4	119	16	3.9-100	950

<sup>1</sup>For the purposes of this table, available drawdown is defined as the distance from the static-water level to the base of the aquifer or bottom of the well for unconfined stratified-drift aquifers and for till; and the distance from the static-water level to the top of the aquifer for confined stratified-drift aquifers and for bedrock.

<sup>2</sup>Calculated value equal to median specific capacity multiplied by  $\frac{1}{2}$  of the median available drawdown.

<sup>3</sup>Calculated value higher but reduced because drawdown from well losses would be significant at higher pumping rates in a typical well.

barium. In this sample, the concentration of dissolved sulfate is very low, thereby allowing for elevated concentrations of dissolved barium, strontium, and radium. A possible explanation for the low sulfate concentration is the reduction of sulfate to sulfide by anaerobic bacteria and its eventual escape as hydrogen-sulfide gas (Moore and Staubitz, 1984). Wells that penetrate zones containing highly saline groundwater commonly produce hydrogen-sulfide and/or methane gas.

The analyses of groundwater from 223 pumped wells (Table 20) include data from the 22 wells that penetrated restricted-flow zones (indicated by "Water-quality analysis" in the "Remarks" column in Table 12). The water pumped from these 22 wells generally is a mixture of water from restricted- and unrestricted-flow zones. Concentrations of total dis-

solved solids for these wells range from 400 to 6,100 mg/L; the median value is 840 mg/L (Table 12). Dissolved-chloride concentrations range from 125 to 3,500 mg/L; the median value is 350 mg/L. Dissolved-barium concentrations range from 560 to 98,000 µg/L (micrograms per liter); the median value is 2,100 µg/L. Dissolved-strontium concentrations range from 140 to 80,000 µg/L; the median value is 1,350 µg/L. Dissolved-sulfate concentrations generally are at or below the detection limit of 5 to 10 mg/L.

Water from 10 wells (eight of which produce water from restricted-flow zones) was analyzed for radium-226 and radium-228 (Table 8); concentrations range from less than 0.03 to 17 pCi/L (picocuries per liter) and from less than 1.1 to 13 pCi/L, respectively. The median concentration for radium-

Table 8. Total-Radium Analyses of Water From Selected Wells<sup>1</sup>

Well number	Total radium-226 (pCi/L)	Total radium-228 (pCi/L)
<i>Bradford County</i>		
Br-271	0.05	<3.8
695	1.8	<1.4
713	.67	<1.6
721	<.03	<1.3
752	.27	<2.0
<i>Potter County</i>		
Po-226	.45	<1.1
263	1.0	1.9
<i>Tioga County</i>		
Ti-445	.28	<1.8
486	1.4	1.7
498	17	13

<sup>1</sup>Dates of collection were April 28 and 29, 1986.

226 is 0.56 pCi/L, and for radium-228 the median is 1.8 pCi/L.

Groundwater-quality problems resulting from human activities are not common in the study area, although sewage, animal wastes, chemical fertilizers, industrial chemicals and wastes, and petroleum products have contaminated groundwater locally. Because the sources of contamination are near or on the surface, shallow unconfined aquifers are most susceptible to water-quality degradation. Sewage disposal and agricultural application of animal manure and other fertilizers have had the most widespread effect on groundwater quality. Contamination from chemical fertilizers increases concentrations of nitrate, and contamination from sewage and animal wastes increases concentrations of nitrate, chloride, and sodium. Water quality in the confined aquifers is less affected by contamination from near-surface sources. For example, water from most confined aquifers has very low nitrate concentrations, and many of the samples are at or below the detection limit of 0.02 to 0.04 mg/L.

Table 14 presents water-quality analyses of samples from a well, before and after deepening, located near Middleburg Center, Tioga County. Well Ti-401, which was completed at a depth of 31 feet, produced water from the unconfined stratified-drift

aquifer. The water in this well contained elevated dissolved-nitrate and dissolved-chloride concentrations, which may be indicative of contamination by sewage. Subsequently, well Ti-401 was deepened to 149 feet. There is no evidence of similar contamination in the deep well, Ti-534, which taps the confined stratified-drift aquifer.

## DESCRIPTION OF SELECTED WATER-QUALITY CONSTITUENTS

### Hardness

The hardness of the groundwater in the study area is primarily caused by dissolved calcium and magnesium, which is related to the calcareous mineral content of the aquifer and the residence time of water in the flow system. Table 15 presents a summary of hardness of water in the aquifers as determined in the field. The unconfined stratified-drift aquifers and the Catskill Formation generally yield moderately hard water (61 to 120 mg/L as CaCO<sub>3</sub>) (Durfor and Becker, 1964, p. 27). The confined stratified-drift aquifers, till, and Lock Haven Formation generally yield hard water (121 to 180 mg/L as CaCO<sub>3</sub>).

### Iron and Manganese

Elevated concentrations of dissolved iron and manganese are common in the groundwater of the study area. About 50 percent of the wells sampled yield water that exceeds the USEPA (U.S. Environmental Protection Agency) SMCL (secondary maximum contaminant level) for iron and manganese of 300 µg/L and 50 µg/L, respectively. Iron and manganese are highly soluble under reducing conditions, which are common in the confined aquifers or where the groundwater is in contact with organic material. For example, well Ti-512, completed in stratified drift below extensive swamp deposits at Wellsboro Junction, Tioga County, contains water having a dissolved-iron concentration of 6,650 µg/L. As seen in Table 14, well Ti-401 contains water having a dissolved-iron concentration of 4,530 µg/L from the unconfined stratified-drift aquifer, which may have been contaminated by sewage. Tables 16 and 17 present summaries of

Table 9. Source and Significance of Selected Dissolved Constituents and Properties of Groundwater<sup>1</sup>

Constituent or property	Source or cause	Significance <sup>2</sup>
Alkalinity (as CaCO <sub>3</sub> )	The major cause of alkalinity is the bicarbonate (HCO <sub>3</sub> ) and to some extent the carbonate (CO <sub>3</sub> ) ions, which are dissolved from carbonate rocks and cement by carbon dioxide in the groundwater.	Bicarbonates of calcium and magnesium decompose in steam boilers and other hot-water facilities to form scale and release corrosive carbon dioxide gas (see "Hardness"). The typical concentration in groundwater is 100 to 400 mg/L. <sup>3</sup>
Aluminum (Al)	Dissolved in small quantities from aluminum-bearing rocks. Water having a low pH commonly contains large amounts. <sup>4</sup>	May form scale in boiler tubes. There is no recommended limit in the United States. Maximum limit recommended for drinking water in Great Britain is 200 µg/L. The typical concentration in groundwater is 1 to 60 µg/L. <sup>3</sup>
Ammonia (NH <sub>3</sub> )	Found in many waters but usually only in trace amounts. Found in waters polluted with sewage and other organic waste. <sup>4</sup>	Generally indicates organic pollution. Ammonium salts are destructive to concrete made from portland cement and, in concentrations exceeding 0.02 mg/L of NH <sub>3</sub> , are toxic to freshwater aquatic life. <sup>5</sup>
Arsenic (As)	Dissolved in small quantities from arsenic-bearing rocks. Excessive concentrations are generally due to improper waste disposal practices. Arsenic is also present in certain insecticides and herbicides.	Concentrations above 50 µg/L may be toxic and are considered grounds for rejection of a water supply. The typical concentration in groundwater is less than 1 µg/L. <sup>5</sup>
Barium (Ba)	Dissolved from barium-bearing rocks, barium salts (barite and witherite), and manganese-oxide deposits.	Barium ingestion can cause serious toxic effects on the heart, where it acts as a muscle stimulant; on blood vessels, by constricting the blood vessels and increasing blood pressure; and on the central nervous system, causing spasms and possible paralysis. The maximum recommended limit for drinking water is 1 mg/L.
Cadmium (Cd)	Dissolved in small quantities from cadmium-bearing rocks. Excessive concentrations are generally due to contamination by industrial wastes from metal-plating operations.	Concentrations above 10 µg/L may be toxic and are considered grounds for rejection of a water supply. <sup>5</sup>
Calcium (Ca) and magnesium (Mg)	Dissolved from practically all rocks and soils, especially from limestone, dolomite, and gypsum.	Cause of most of the hardness and, in combination with bicarbonate, of scale formation in steam boilers, water heaters, and pipes (see "Hardness"). Water low in calcium and magnesium is desired in electroplating, tanning, dyeing, and textile manufacturing. Maximum limits recommended for drinking water are 100 mg/L for calcium and 50 mg/L for magnesium. <sup>3</sup>
Chloride (Cl)	Dissolved from rocks and soils in small quantities. Relatively large amounts are derived from sewage, industrial wastes, and highway salting.	In large quantities chloride increases the corrosiveness of water. Large amounts in combination with sodium give a salty taste. The USEPA SMCL is 250 mg/L. <sup>6</sup>
Chromium (Cr)	Dissolved in minute quantities from chromium-bearing rocks. Excessive concentrations are generally due to contamination by industrial wastes.	Maximum limit recommended for drinking water is 50 µg/L. <sup>5</sup>
Copper (Cu)	Dissolved from copper-bearing rocks. Small amounts (less than 1.0 mg/L) are generally found in natural waters. Small amounts are commonly added to water in reservoirs to inhibit algal growth.	Copper is essential and beneficial for human metabolism. Concentrations greater than 1.0 mg/L may impart a metallic taste to water. Maximum limit recommended for drinking water, and the USEPA SMCL, is 1.0 mg/L. <sup>6,7</sup>
Fluoride (F)	Dissolved in small to minute quantities from most rocks and soils.	About 1.0 mg/L of fluoride in drinking water is believed to be helpful in reducing the incidence of tooth decay in small children; larger concentrations cause mottling of enamel. Where the 5-year average of daily maximum air

Table 9. (Continued)

Constituent or property	Source or cause	Significance <sup>2</sup>
Fluoride (F) (continued)		temperature ranges from 53.7°F (and below) to 90.0°F, it is recommended that fluoride not exceed 2.4 to 1.4 mg/L, respectively. <sup>5</sup> The USEPA SMCL is 2 mg/L. <sup>6</sup>
Hardness (as CaCO <sub>3</sub> )	In most water nearly all of the hardness is due to calcium and magnesium. All of the metallic cations other than the alkali metals also cause hardness. There are two classes of hardness—carbonate (temporary) and noncarbonate (permanent). Carbonate hardness refers to the hardness resulting from cations in association with carbonate and bicarbonate; it is called temporary because it may be removed by boiling the water. Noncarbonate hardness refers to the hardness resulting from cations in association with other anions.	Hardness consumes soap before a lather will form and deposits soap curds on bathtubs. Carbonate hardness is the cause of scale formation in boilers, water heaters, radiators, and pipes, resulting in a decrease in heat transfer and restricted flow of water. Water of hardness up to 60 mg/L is considered soft; 61 to 120 mg/L, moderately hard; 121 to 180 mg/L, hard; and more than 180 mg/L, very hard. Very soft water that has a low pH may be corrosive to plumbing. The number of milligrams per liter divided by 17.1 yields the concentration in grains per gallon.
Iron (Fe)	Dissolved from practically all rocks and soils. May also be derived from iron pipes, pumps, and other equipment.	On exposure to air, iron in groundwater oxidizes to a reddish-brown precipitate. More than about 300 µg/L stains laundry, porcelain, and utensils reddish brown. Objectionable for food processing, textile processing, beverages, ice manufacturing, brewing, and other processes. Maximum limit recommended for drinking water, and USEPA SMCL, is 300 µg/L. <sup>5,6</sup>
Lead (Pb)	Dissolved in small quantities from lead-bearing rocks. Less than 10 µg/L is generally found in natural waters. Excessive concentrations can be caused by corrosion of lead plumbing.	Lead is accumulated by the body, and excessive concentrations may cause sickness or death. Maximum limit recommended for drinking water is 50 µg/L. <sup>5</sup>
Manganese (Mn)	Dissolved from many rocks and soils. Commonly found associated with iron in natural waters, but is not as common as iron.	More than 200 µg/L precipitates upon oxidation. Manganese has the same undesirable characteristics as iron but is more difficult to remove. Maximum limit recommended for drinking water, and USEPA SMCL, is 50 µg/L. <sup>6,7</sup>
Nickel (Ni)	Dissolved from nickel-bearing rocks, commonly associated with iron and manganese.	Nickel is considered to be nontoxic to man. The typical range of concentration in groundwater is less than 1 to 50 µg/L. <sup>3</sup>
Nitrate (NO <sub>3</sub> )	Decaying organic matter, sewage, and fertilizers are principal sources.	Small concentrations have no effect on the usefulness of water. Most groundwater contains less than 2 mg/L of NO <sub>3</sub> as N. The limit recommended for drinking water is 10 mg/L of NO <sub>3</sub> as N. <sup>5</sup> Water containing more than this level may cause methemoglobinemia (a disease that may be fatal in infants) and, therefore, should not be used in infant feeding.
Nitrite (NO <sub>2</sub> )	Found in sewage and other organic wastes. Unstable in the presence of oxygen, and only present in small amounts in most waters. <sup>4</sup>	Presence of nitrite is generally an indication of organic pollution. Undesirable in water for some dyeing and brewing processes. <sup>4</sup>
Phosphate (PO <sub>4</sub> )	Dissolved in very small quantities from most rocks and soils. The chief sources are fertilizer and detergents.	Concentrations much greater than local averages may indicate contamination from phosphate detergents and/or fertilizers.
Radium-226 ( <sup>226</sup> Ra)	Radium-226 is a decay product of uranium-238. Concentrations of radium are generally greater in shales than in limestones, sandstones, and quartzites. Radium is most mobile in reducing, chloride-rich ground-	Radium-226 is a bone-marrow seeker, and forms bone sarcomas and head carcinomas. Maximum recommended limit is 3 pCi/L. <sup>8</sup>

Table 9. (Continued)

Constituent or property	Source or cause	Significance <sup>2</sup>
Radium-226 ( <sup>226</sup> Ra) (continued)	water having elevated total-dissolved-solid concentrations. <sup>9</sup>	
Radium-228 ( <sup>228</sup> Ra)	Radium-228 is a decay product of thorium-232. Concentrations of radium are generally greater in shales than in limestones, sandstones, and quartzites. Radium is most mobile in reducing, chloride-rich groundwater having elevated total-dissolved-solid concentrations. <sup>9</sup>	Radium-228 is a bone-marrow seeker, and forms bone sarcomas. Maximum recommended limit is 5 pCi/L for combined radium-228 and radium-226. <sup>8</sup>
Silica (SiO <sub>2</sub> )	Dissolved from practically all rocks and soils (commonly less than 30 mg/L).	Forms hard scale in pipes and boilers. When carried over in the steam of high-pressure boilers, it forms deposits on turbine blades.
Sodium (Na) and potassium (K)	Dissolved from practically all rocks and soils. Sewage and industrial wastes are also major sources.	Concentrations of less than 50 mg/L have little effect on the usefulness of water for most purposes. More than 50 mg/L may cause foaming in steam boilers and limit the use of water for irrigation.
Sulfate (SO <sub>4</sub> )	Dissolved from rocks and soils containing gypsum, iron sulfides, and other sulfur compounds. Commonly present in some industrial wastes and sewage.	Sulfates in water containing calcium may form hard calcium sulfate scale in steam boilers. The USEPA SMCL is 250 mg/L. <sup>6</sup>
Zinc (Zn)	Dissolved from zinc-bearing rocks. May be dissolved from galvanized pipe and is present in many industrial wastes.	Concentrations greater than 30 mg/L have been known to cause nausea and fainting and may impart a metallic taste and milky appearance to water. The maximum limit recommended for drinking water, and the USEPA SMCL, is 5 mg/L. <sup>6,7</sup>
Dissolved solids (total)—A measure of all of the chemical constituents dissolved in a particular water. The maximum limit recommended for drinking water is 500 mg/L, but water containing up to 1,000 mg/L may be used where less mineralized supplies are not available.		
pH—The negative logarithm of the hydrogen-ion concentration. A pH of 7.0 indicates neutrality of a solution. Values higher than 7.0 denote alkaline solutions; values lower than 7.0 indicate acidic solutions. Corrosiveness of water generally increases with decreasing pH. The recommended range for pH is from 6.5 to 8.5.		
Specific conductance—A measure of the capacity of water to conduct an electrical current, given in micromhos per centimeter at 25°C. It varies with the concentration and degree of ionization of the constituents. It may be used to estimate the dissolved-solid concentration of water.		
Temperature—The temperature of groundwater that occurs between the water table and about 60 feet below the water table is approximately the same as the average annual air temperature; below this point, groundwater temperatures increase with depth about 1°F for each 50 to 100 feet. <sup>10</sup>		
<sup>1</sup> Modified from Lloyd and Growitz (1977).		
<sup>2</sup> Recommended and mandatory drinking-water limits are from Pennsylvania Department of Environmental Resources, Bureau of Community Environmental Control (1986), p. I-15 and I-18, except where otherwise indicated.		
<sup>3</sup> Cook and Miles (1980).		
<sup>4</sup> Ward and Wilmoth (1968), p. 20-22.		
<sup>5</sup> U.S. Environmental Protection Agency (1976).		
<sup>6</sup> U.S. Environmental Protection Agency (1988).		
<sup>7</sup> National Academy of Sciences, Committee on Water Quality Criteria (1973).		
<sup>8</sup> U.S. Environmental Protection Agency (1985).		
<sup>9</sup> Tanner (1964).		
<sup>10</sup> Lovering and Goode (1963).		

**Table 10. Median Values of Specific Conductance, Hardness, Alkalinity, and Concentrations of Selected Dissolved Constituents in the Aquifers**

(Quantities are in milligrams per liter unless otherwise indicated)

Aquifer	Specific conductance ( $\mu\text{mho}/\text{cm}$ at 25°C)		Hardness (as $\text{CaCO}_3$ )		Sodium		Alkalinity (as $\text{CaCO}_3$ )		Chloride		Nitrate (as N)	Iron ( $\mu\text{g}/\text{L}$ )	Manganese ( $\mu\text{g}/\text{L}$ )
	Calcium	Magnesium	Potassium	Sulfate	Nitrate	Iron							
Stratified drift	290	120	37	6.7	8.1	1.0	110	23	13	0.30	220	50	
Unconfined	260	110	35	6.7	7.4	1.1	90	21	13	.53	120	40	
Confined	340	150	47	7.4	10	.9	130	26	14	.04	660	140	
Till	400	140	45	12	33	1.3	190	25	6	.04	600	240	
Bedrock	420	100	31	7.9	23	1.9	140	10	11	.04	190	40	
Catskill Formation	270	85	26	5.5	11	2.0	90	10	10	.16	90	30	
Lock Haven Formation	470	140	39	10	28	1.1	180	16	12	.04	270	50	

Table 11. Summary of Concentration of Total Dissolved Solids in the Aquifers

Aquifer	Number of sampled wells	Concentration of total dissolved solids (mg/L)					
		90 percent <sup>1</sup>	75 percent <sup>1</sup>	50 percent <sup>1</sup> (median)	25 percent <sup>1</sup>	10 percent <sup>1</sup>	Range
Stratified drift	85	110	150	200	280	410	42-1,100
Unconfined	59	80	130	180	250	320	42-680
Confined	26	130	170	230	350	450	100-1,100
Till	19	200	250	280	360	640	110-850
Bedrock	92	110	140	260	370	740	52-6,100
Hunley Mountain Formation	1	—	—	—	—	—	66
Chadakoin Formation	2	—	—	—	—	—	150-360
Catskill Formation	38	84	120	160	370	710	54-1,300
Lock Haven Formation	51	150	220	300	380	820	52-6,100

<sup>1</sup>Percentage of sampled wells in which indicated value was equaled or exceeded.

water-quality analyses for iron and manganese. Only the unconfined stratified-drift aquifers and the Catskill Formation yield water with median concentrations that are lower than the USEPA SMCL. Wells completed in till typically yield water having the highest concentrations of both constituents.

### Nitrate

Common sources of nitrate in the groundwater of the study area are sewage, animal manure, and chemical fertilizers. Table 18 summarizes dissolved-nitrate concentrations. Unconfined stratified-drift aquifers generally yield water having the highest nitrate concentrations, whereas confined stratified-drift aquifers, till, and bedrock generally yield water having lower nitrate concentrations. Only one of the wells sampled (well Br-230, completed in an unconfined stratified-drift aquifer) produces water that exceeds the USEPA MCL (maximum contaminant level) of 10 mg/L as N. An additional five wells, four of which were completed in unconfined stratified-drift aquifers and one that was completed in till, produce water with nitrate concentrations greater than 5 mg/L as N.

### Chloride

Possible major sources of chloride in the groundwater of the study area are sewage (primarily from septic tanks), animal manure, highway road salt,

and saline groundwater from restricted-flow zones. Table 19 contains a summary of dissolved-chloride concentrations in the aquifers. Median concentrations of chloride are less than 15 mg/L for all aquifers. About 7 percent of the wells sampled produce water that exceeds the USEPA SMCL of 250 mg/L. All these wells are open to restricted-flow zones in bedrock or till, which contain saline groundwater. Wells Br-230 and Ti-401 (see Tables 20 and 21), which are completed at depths of 32 and 31 feet in unconfined stratified-drift aquifers, produce water with chloride concentrations of 183 and 214 mg/L, respectively, which may indicate local contamination.

Elevated concentrations of chloride in bedrock, till, and confined stratified-drift aquifers generally are attributable to naturally occurring sodium chloride from restricted-flow zones, whereas elevated chloride concentrations in shallow, unconfined stratified-drift aquifers probably are an indication of localized contamination from the activities of humans.

### Barium

Concentrations of dissolved barium that exceed the USEPA MCL of 1 mg/L are commonly found in groundwater from wells that penetrate restricted-flow zones. Twelve wells contain water that exceeds the USEPA MCL for barium; the median dissolved barium concentration of the 12 was 2,050

Table 12. Inventory of Wells That Produce Water of the Sodium Chloride Type From Restricted-Flow Zones

Well number	Depth of well (feet)	Depth of casing (feet)	Depth to restricted-flow zone (feet)	Dis-solved solids (mg/L)	Chloride, dis-solved (mg/L)	Barium, dis-solved ( $\mu\text{g/L}$ )	Strontrium, dis-solved ( $\mu\text{g/L}$ )	Sulfate, dis-solved (mg/L)	Aquifer <sup>1</sup>	Remarks <sup>2</sup>
BRADFORD COUNTY										
Br- 7	720	40	>288	—	—	—	—	—	Dlh	Reported salty
20	300	100	—	—	620	—	—	2.0	Dlh	Water-quality analysis
21	207	100	200	—	—	—	—	—	Dlh	Reported salty
22	412	75	190	—	—	—	—	—	Dlh	do.
79	138	—	—	—	—	—	—	—	Dck	do.
85	600	—	—	1,100	560	—	—	15	Dlh	Water-quality analysis
92	117	55	104	—	168	—	—	1.0	Dlh	Specific-conductance log, water-quality analysis
202	180	147	165	760	360	560	1,100	<5.0	Dlh	Water-quality analysis
205	100	42	—	500	206	1,620	1,900	<5.0	Dlh	do.
209	266	144	—	2,500	1,200	—	14,000	<5.0	Dlh	do.
238	298	170	290	664	234	890	650	5.0	Dlh	do.
271	110	71	100	6,100	3,500	98,000	80,000	10	Dlh	do.
513	511	80	400	—	—	—	—	—	Dck	Reported salty
557	296	104	210	—	—	—	—	—	Dlh	Specific-conductance log
695	37	37	37	400	125	3,900	140	11	Qsd/c	Water-quality analysis
713	119	119	115	846	336	1,800	820	22	Qt	do.
752	58	58	60	722	319	1,020	980	11	Qt	do.
818	160	78	138	—	—	—	—	—	Dlh	Reported salty
POTTER COUNTY										
Po- 76	218	66	—	1,260	670	—	—	—	Dck	Water-quality analysis
175	106	40	—	950	687	2,180	1,400	<10	Dck	do.
226	65	31	—	578	245	2,000	—	10	Dck	do.
263	125	72	—	1,220	609	21,000	—	<10	Dck	do.
TIoga COUNTY										
Ti- 4	285	130	—	—	300	—	—	15	Dck	Water-quality analysis
5	107	107	96	—	—	—	—	—	Qsd/c	Reported salty
6	106	106	103	—	—	—	—	—	Qsd/c	do.
9	175	—	—	—	—	—	—	—	Dlh	do.
27	500	93	450	—	—	—	—	—	Dck	do.
29	215	70	—	—	—	—	—	—	Dlh	do.
30	580	70	—	—	—	—	—	—	Dlh	do.
36	560	43	240	—	—	—	—	—	Dck	do.
39	256	112	215	—	—	—	—	—	Dck	do.
45	168	90	—	—	—	—	—	—	Dlh	do.
47	410	40	—	—	1,820	—	—	7.0	Dlh	Water-quality analysis
52	102	102	100	—	465	—	—	2.0	Qsd/c	do.
63	200	80	—	—	—	—	—	—	Dlh	Reported salty
257	220	161	215	638	240	—	—	15	Dck	Water-quality analysis
294	99	65	95	1,060	566	1,200	440	10	Dlh	do.
486	124	122	—	588	304	2,100	1,735	10	Dck	do.
492	150	70	—	—	—	—	—	—	Dlh	Reported salty
498	158	149	150	830	193	2,200	1,600	91	Dlh	Specific-conductance log, water-quality analysis
523	>100	50	—	—	—	—	—	—	Dlh	Reported 570 mg/L chloride
531	212	—	—	—	—	—	—	—	Dck	Reported salty
532	265	—	260	—	—	—	—	—	Dck	do.
533	185	—	—	—	—	—	—	—	Dck	do.

<sup>1</sup>Qsd/c, stratified drift/confined; Qt, till; Dck, Catskill Formation; Dlh, Lock Haven Formation.

<sup>2</sup>Basis for determining that well produces water of the sodium chloride type from a restricted-flow zone.

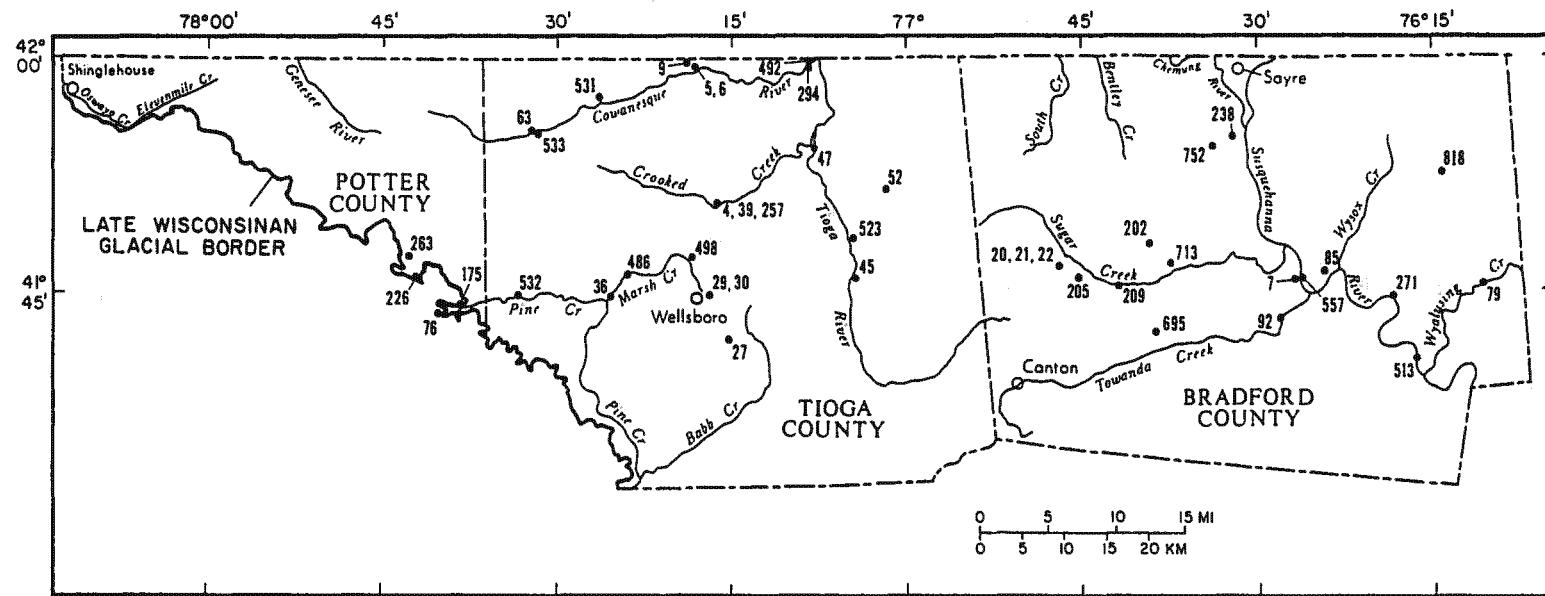


Figure 19. Locations of wells (black dots) that produce water of the sodium chloride type from restricted-flow zones (numbers are county well numbers; glacial border is from Crowl and Sevon, 1980).

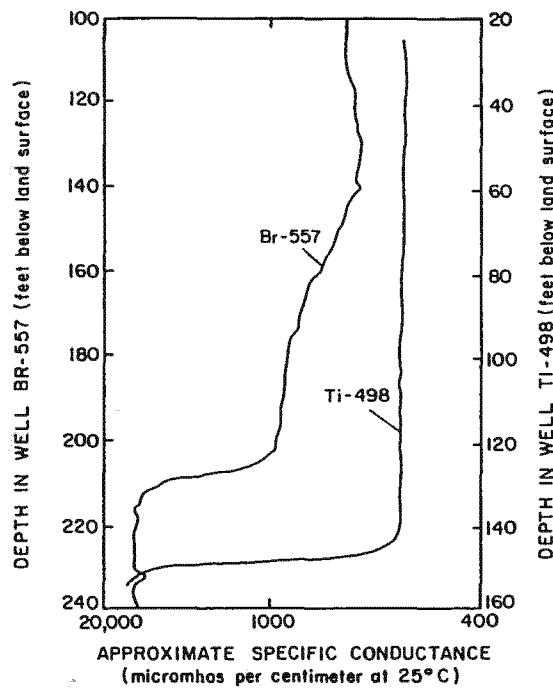


Figure 20. Specific-conductance logs of wells Ti-498 at Wellsboro Junction, Tioga County, and Br-557 at Wysox, Bradford County.

$\mu\text{g/L}$ . Eight of the 12 wells are completed in bedrock, three in till, and one in confined stratified drift. Median concentrations of dissolved chloride and total dissolved solids in water produced from the wells that exceeded the USEPA MCL for barium were 312 and 776  $\text{mg/L}$ , respectively. Seven of the 12 wells contain water that exceeds USEPA SMCL for dissolved chloride and 10 of the 12 contain water that exceeds USEPA SMCL for total dissolved solids.

## SUMMARY

Saturated sand and gravel of outwash, deltaic, and ice-contact origin forms important unconfined and confined aquifers in the major valleys north of the late Wisconsinan glacial border in Bradford, Tioga, and Potter Counties, Pennsylvania. Lacustrine deposits of silt, clay, and very fine sand com-

Table 13. Water-Quality Analysis of a Sample From the Restricted-Flow Zone Penetrated by Well Ti-498 at Wellsboro Junction, Tioga County

(Quantities are in milligrams per liter unless otherwise indicated)

Constituent	Concentration
Alkalinity as $\text{CaCO}_3$	150
Total dissolved solids	7,800
Calcium, dissolved	330
Magnesium, dissolved	43
Sodium, dissolved	2,500
Potassium, dissolved	24
Chloride, dissolved	4,600
Sulfate, dissolved	13
Barium, dissolved ( $\mu\text{g/L}$ )	36,000
Iron, dissolved ( $\mu\text{g/L}$ )	1,800
Manganese, dissolved ( $\mu\text{g/L}$ )	140
Strontium, dissolved ( $\mu\text{g/L}$ )	1,600
Radium-226, total ( $\text{pCi/L}$ )	17
Radium-228, total ( $\text{pCi/L}$ )	13

Table 14. Water-Quality Analyses of Samples From a Well Near Middleburg Center, Tioga County, Before (Ti-401) and After (Ti-534) Deepening

(Quantities are in milligrams per liter unless otherwise indicated)

Well number	Ti-401	Ti-534
Well depth (feet)	31	149
Aquifer <sup>1</sup>	Qsd/u	Qsd/c
Total dissolved solids	624	206
Nitrate, dissolved as N	7.04	<.02
Sodium, dissolved	79	6.3
Chloride, dissolved	214	14
Sulfate, dissolved	65	29
Barium, dissolved ( $\mu\text{g/L}$ )	120	150
Iron, dissolved ( $\mu\text{g/L}$ )	4,530	590
Manganese, dissolved ( $\mu\text{g/L}$ )	590	290

<sup>1</sup>Qsd/u, stratified drift/unconfined; Qsd/c, stratified drift/confined.

prise thick and extensive confining units in most of the major valleys. Glacially eroded bedrock and till are the basal confining units of the stratified-drift aquifer systems.

In valley areas underlain by surficial sand and gravel, stratified-drift aquifers are recharged at an average rate of about 1 ( $\text{Mgal/d}/\text{mi}^2$ ) by direct in-

Table 15. Summary of Total Hardness (as Calcium Carbonate) in the Aquifers

Aquifer	Number of sampled wells	Total hardness (in mg/L as CaCO <sub>3</sub> )					
		90 percent <sup>1</sup>	75 percent <sup>1</sup>	50 percent <sup>1</sup> (median)	25 percent <sup>1</sup>	10 percent <sup>1</sup>	Range
Stratified drift	126	40	70	120	170	220	15-600
Unconfined	96	35	70	110	180	220	15-450
Confined	30	85	100	150	170	260	70-600
Till	25	70	100	140	180	220	50-260
Bedrock	104	50	70	100	170	230	20-820
Huntley Mountain Formation	2	—	—	—	—	—	50
Chadakoin Formation	2	—	—	—	—	—	35-50
Catskill Formation	44	40	70	85	120	210	20-500
Lock Haven Formation	56	50	85	140	190	270	35-820

<sup>1</sup>Percentage of sampled wells in which indicated value is equaled or exceeded.

Table 16. Summary of Dissolved-Iron Concentrations in the Aquifers

Aquifer	Number of sampled wells	Dissolved-iron concentration (µg/L)					
		90 percent <sup>1</sup>	75 percent <sup>1</sup>	50 percent <sup>1</sup> (median)	25 percent <sup>1</sup>	10 percent <sup>1</sup>	Range
Stratified drift	100	16	91	220	830	2,400	10-12,000
Unconfined	69	10	75	120	370	2,400	10-12,000
Confined	31	40	340	660	1,700	2,800	10-6,600
Till	19	100	270	600	2,300	2,700	40-15,900
Bedrock	99	30	70	190	540	1,000	10-5,600
Huntley Mountain Formation	1	—	—	—	—	—	10
Chadakoin Formation	2	—	—	—	—	—	<10-140
Catskill Formation	41	10	37	90	260	830	10-5,600
Lock Haven Formation	55	60	170	270	720	1,200	10-3,800

<sup>1</sup>Percentage of sampled wells in which indicated value is equaled or exceeded.

Table 17. Summary of Dissolved-Manganese Concentrations in the Aquifers

Aquifer	Number of sampled wells	Dissolved-manganese concentration (µg/L)			
		50 percent <sup>1</sup> (median)	25 percent <sup>1</sup>	10 percent <sup>1</sup>	Range
Stratified drift	96	50	210	620	2-6,100
Unconfined	66	40	120	600	2-4,300
Confined	30	140	320	710	<10-6,100
Till	19	240	430	780	<10-1,500
Bedrock	91	40	110	290	<10-2,600
Huntley Mountain Formation	1	—	—	—	<10
Chadakoin Formation	2	—	—	—	<10
Catskill Formation	36	30	97	180	<10-1,000
Lock Haven Formation	52	50	140	490	<10-2,600

<sup>1</sup>Percentage of sampled wells in which indicated value is equaled or exceeded; the 90 and 75 percent values are not shown because of inconsistent detection limits reported by the laboratory.

Table 18. Summary of Dissolved-Nitrate Concentrations in the Aquifers

Aquifer	Number of sampled wells	Dissolved-nitrate concentration (mg/L as N)				
		50 percent <sup>1</sup> (median)	25 percent <sup>1</sup>	10 percent <sup>1</sup>	Range	
Stratified drift	84	0.30	1.8	3.8	<0.01-14	
Unconfined	58	.53	2.0	4.3	<.02-14	
Confined	26	.04	.82	3.4	<.01-4.4	
Till	19	.04	.82	2.7	<.02-6.4	
Bedrock	88	.04	.36	.88	<.01-4.4	
Huntley Mountain Formation	1	—	—	—	.08	
Chadakoin Formation	2	—	—	—	.04-.70	
Catskill Formation	37	.16	.50	1.2	<.01-2.4	
Lock Haven Formation	48	.04	.13	.69	<.01-4.4	

<sup>1</sup>Percentage of sampled wells in which indicated value is equaled or exceeded; the 90 and 75 percent values are not shown because of inconsistent detection limits reported by the laboratory.

Table 19. Summary of Dissolved-Chloride Concentrations in the Aquifers

Aquifer	Number of sampled wells	Dissolved-chloride concentration (mg/L)					
		90 percent <sup>1</sup>	75 percent <sup>1</sup>	50 percent <sup>1</sup> (median)	25 percent <sup>1</sup>	10 percent <sup>1</sup>	
Stratified drift	95	3	5	13	26	39	1-465
Unconfined	67	3	4	13	25	37	1-210
Confined	28	2	8	14	33	130	2-465
Till	18	2	2	6	31	320	2-340
Bedrock	102	2	4	11	76	340	1-3,500
Huntley Mountain Formation	1	—	—	—	—	—	6
Chadakoin Formation	2	—	—	—	—	—	4-46
Catskill Formation	43	2	3	10	55	300	1-690
Lock Haven Formation	56	2	4	12	110	560	1-3,500

<sup>1</sup>Percentage of sampled wells in which indicated value is equaled or exceeded.

filtration of precipitation. Recharge is also available from infiltration of upland runoff and groundwater inflow. The rate of this recharge is about 1 (Mgal/d)/mi<sup>2</sup> from bordering uplands not drained by tributary streams. Tributary streams that drain uplands and then flow across alluvial fans on the valley floor commonly recharge the underlying stratified-drift aquifers at a rate of about 590 (gal/d)/ft of stream reach. Induced infiltration is a significant source of recharge to well fields pumping from unconfined stratified-drift aquifers that are in good hydraulic connection with surface-water bodies.

Public suppliers and other selected users of groundwater in the study area pumped 10.8 Mgal/d in 1985. Seventy-five percent of this groundwater

was pumped by GTE Sylvania at North Towanda and the Sayre Water Company at Tioga Point, Bradford County, and by the U.S. Fish and Wildlife Service at Asaph, Tioga County; the well fields tap unconfined stratified-drift aquifers that are recharged by induced infiltration or tributary-stream infiltration.

Most of the wells completed in stratified-drift aquifers have specific capacities an order of magnitude greater than those completed in till and bedrock. Most of the wells in the Catskill Formation, which is comparatively coarse grained, have specific capacities greater than those in the Lock Haven Formation. Median specific capacities and calculated yields of wells in selected areas underlain by unconfined stratified-drift aquifers range from 2.5

to 390 (gal/min)/ft and from 25 to 3,000 gal/min, respectively. Median specific capacities and calculated yields of wells in selected areas underlain by confined stratified drift range from 11 to 16 (gal/min)/ft and from 480 to 950 gal/min, respectively.

The hydrogeochemical system in the glaciated valleys of the study area can be classified into two major zones: (1) a zone of unrestricted groundwater flow that contains water of the calcium bicarbonate type, and (2) a zone of restricted groundwater flow that contains water of the sodium chloride type. Unrestricted groundwater flow occurs in the unconfined and confined stratified-drift aquifers, and in many of the till and shallow bedrock systems. Restricted groundwater circulation is present in the bedrock of the major valleys and, in some areas, in the overlying till and confined stratified-drift aquifers. Water samples from wells that penetrate zones having restricted flow contain median concentrations of total dissolved solids, dissolved chloride, and dissolved barium of 830 mg/L, 348 mg/L, and 2,000  $\mu\text{g}/\text{L}$ , respectively.

Unconfined stratified-drift aquifers generally yield water with the highest nitrate (as N) concentration, although only one of the wells sampled produces water that exceeds the USEPA MCL. Water in about 50 percent of the wells sampled exceeds the USEPA SMCL for iron or manganese. Only water in the unconfined stratified-drift aquifers and the Catskill Formation has median concentrations of iron and manganese lower than the USEPA SMCL.

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## FACTORS FOR CONVERTING INCH-POUND UNITS TO INTERNATIONAL SYSTEM UNITS (SI)

<i>Multiply inch-pound units</i>	<i>By</i>	<i>To obtain SI units</i>
inch (in.)	<i>Length</i> 25.4	millimeter (mm)
foot (ft)	.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile ( $\text{mi}^2$ )	<i>Area</i> 2.590	square kilometer ( $\text{km}^2$ )
gallon per minute (gal/min)	<i>Flow</i> .06308	liter per second (L/s)
million gallons per day (Mgal/d)	3,785	kiloliter per day (kL/d)
million gallons per day per square mile ( $[\text{Mgal/d}]/\text{mi}^2$ )	1,460	kiloliter per day per square kilometer ( $[\text{kL/d}]/\text{km}^2$ )
gallon per minute per foot ([gal/min]/ft)	<i>Specific Capacity</i> .2070	liter per second per meter ([L/s]/m)
gallon per day per foot ([gal/d]/ft)	.0124	square meter per day ( $\text{m}^2/\text{d}$ )
micromhos ( $\mu\text{mho}$ )	<i>Specific Conductance</i> 1.0	microsiemens ( $\mu\text{S}$ )
degree Fahrenheit ( $^{\circ}\text{F}$ )	<i>Temperature</i> $^{\circ}\text{C} = 5/9(^{\circ}\text{F}-32)$	degree Celsius ( $^{\circ}\text{C}$ )

Milligrams per liter (mg/L) is an expression of concentration that is equivalent to parts per million (ppm) and is equal to 1,000 micrograms per liter ( $\mu\text{g/L}$ ).

Micrograms per liter is equivalent to parts per billion (ppb).



Table 20. Chemical Analyses

Well number	Date of collection	Aquifer <sup>1</sup>	pH (units)	Calcium, dis-solved (mg/L)	Magnesium, dis-solved (mg/L)	Sodium, dis-solved (mg/L)	Potassium, dis-solved (mg/L)	Alkalinity (mg/L)	Sulfate, dis-solved (mg/L)	Chloride, dis-solved (mg/L)	Fluoride, dis-solved (mg/L)
BRADFORD											
Br- 20	8/12/35	Dlh	—	—	—	—	190	2.0	620	—	—
32	8/14/35	Dck	—	42	12	—	158	8.0	38	—	—
47	8/ 9/35	Qsd/u	—	101	23	21	228	60	41	—	—
85	8/10/35	Dlh	—	86	14	322	—	15	560	—	—
92	7/11/68	Dlh	—	10	2.4	210	3.5	232	1.0	168	—
112	3/ 9/70	Dck	8.1	—	—	—	148	—	7.5	0.20	—
132	7/21/81	Dlh	7.9	51	11	44	1.0	210	10	5.0	.13
134	7/27/81	Qsd/u	6.7	23	3.9	3.6	.38	44	15	6.0	.11
152	8/ 4/81	Dlh	7.0	66	12	22	.78	132	15	44	<10
167	5/25/82	Dck	7.2	38	6.0	14	.90	—	5.0	3.0	.10
202	8/24/81	Dlh	8.4	22	7.9	271	2.8	216	<5.0	360	<10
205	8/25/81	Dlh	8.1	21	4.6	156	3.4	184	<5.0	206	.42
209	8/25/81	Dlh	7.8	166	31	556	8.4	202	<5.0	1,200	.30
212	8/25/81	Qt	7.3	69	22	26	1.3	240	55	4.0	<10
230	8/25/81	Qsd/u	8.6	123	24	112	2.9	272	35	183	<10
232	8/25/81	Qsd/c	6.5	27	4.3	15	.64	112	<5.0	2.0	<10
235	8/25/81	Qsd/c	7.2	66	27	51	1.5	288	75	12	<10
237	8/26/81	Qsd/u	7.0	35	6.5	4.3	.78	86	15	10	<10
238	8/25/81	Dlh	6.6	12	2.9	245	1.7	240	5.0	234	.26
242	8/20/81	Qt	7.8	42	10	27	1.0	184	20	2.0	.10
249	7/13/82	Dck	8.8	2.9	.60	132	3.0	—	10	38	.40
250	7/14/82	Dck	7.6	46	9.2	6.5	.20	—	15	16	.20
251	7/14/82	Dck	7.4	44	11	23	5.0	—	20	6.0	.20
256	7/19/82	Dck	7.6	39	5.5	12	2.0	—	10	5.0	.10
270	7/20/82	Dlh	5.2	40	12	13	2.0	—	10	1.0	.20
271	7/20/82	Dlh	7.0	235	33	2,000	25	—	10	3,500	.20
272	7/20/82	Dck	6.5	54	9.9	28	2.0	—	35	55	.10
273	7/20/82	Dlh	7.0	51	16	6.6	3.0	—	25	2.0	.20
274	7/20/82	Dlh	7.1	29	9.9	75	7.0	—	10	2.0	.20
275	7/21/82	Dck	7.9	39	7.4	66	3.8	172	20	47	.15
302	7/12/82	Qsd/u	7.7	67	10	6.4	2.0	—	20	29	.20
303	7/12/82	Qsd/c	7.9	61	11	11	2.0	—	20	14	.20
316	7/13/82	Dlh	7.4	87	27	61	2.0	—	—	—	.30
318	7/13/82	Qt	7.6	57	13	16	2.0	—	30	2.0	.30
350	7/20/82	Dck	7.3	22	3.6	119	4.0	—	15	74	.50
357	7/21/82	Dlh	7.4	27	4.5	24	2.0	—	10	14	.20
376	7/21/82	Dlh	7.1	44	10	22	3.0	—	10	4.0	.20
377	7/21/82	Dlh	7.2	45	11	38	3.0	—	10	4.0	.20
378	7/21/82	Dlh	7.3	34	10	38	4.0	180	15	5.0	.20
387	4/29/86	Qsd/u	7.2	24	5.9	8.1	1.5	52	15	22	.17
390	4/29/86	Qsd/u	7.0	9.2	2.1	35	1.1	50	20	21	.10
435	7/14/82	Dlh	7.4	72	41	14	2.8	258	75	5.0	.16
476	7/20/82	Dlh	8.2	13	2.7	143	4.0	—	85	28	.30
496	7/21/82	Qsd/u	6.7	25	9.1	7.4	2.0	—	15	16	.10
528	7/27/82	Dck	7.1	25	4.0	5.0	1.0	—	5.0	2.0	—
529	7/27/82	Dck	7.1	36	5.3	14	3.0	—	5.0	10	—
552	4/28/86	Qsd/u	8.1	59	12	7.4	1.2	148	28	16	.10
604	8/ 2/83	Qsd/u	7.0	51	8.8	6.9	1.5	122	20	4.0	<10
606	8/ 2/83	Qsd/u	6.9	—	—	—	—	82	30	3.0	<10
612	8/ 3/83	Qt	6.6	95	12.9	43	3.2	164	35	5.0	<10
620	8/ 4/83	Qsd/u	7.0	46	8.5	12	1.8	124	15	14	<10
621	6/28/84	Qt	7.9	45	12	43	.80	226	18	15	.18
622	8/ 4/83	Dlh	6.5	30	7.4	3.2	1.2	82	20	19	<10
627	7/11/84	Qsd/u	7.2	40	7.6	32	1.0	134	10	—	<10
630	8/ 4/83	Dlh	7.2	86	20	18	2.2	258	40	3.0	<10
632	8/ 8/83	Qsd/u	7.0	35	6.9	7.8	1.1	120	10	21	.10

## of Water From Selected Wells

Dis-solved solids (mg/L)	Nitrate, dis-solved as N (mg/L)	Alu-minum, dis-solved (µg/L)	Arsenic, dis-solved (µg/L)	Barium, dis-solved (µg/L)	Cad-mium, dis-solved (µg/L)	Chro-mium, dis-solved (µg/L)	Iron, dis-solved (µg/L)	Lead, dis-solved (µg/L)	Manga-nese, dis-solved (µg/L)	Nickel, dis-solved (µg/L)	Stron-tium, dis-solved (µg/L)	Zinc, dis-solved (µg/L)	Well number
<b>COUNTY</b>													
—	—	—	—	—	—	—	—	—	—	—	—	—	Br- 20
—	—	—	—	—	—	—	310	—	—	—	—	—	32
—	—	—	—	—	—	—	90	—	—	—	—	—	47
1,100	—	—	—	—	—	—	—	—	—	—	—	—	85
—	—	—	—	—	—	—	3,300	—	—	—	—	—	92
330	<0.02	50	5	—	—	—	90	—	—	—	—	—	112
300	1.46	60	<5	—	—	—	10	1,040	—	140	10	—	20
370	4.40	70	<5	—	—	—	<10	110	—	10	10	—	132
170	.42	740	—	—	—	—	<10	60	—	100	10	—	134
760	<.02	40	<5	—	560	—	10	190	6	50	10	1,100	40
500	<.02	60	9	1,620	—	—	20	150	<5	40	20	1,900	10
2,500	<.02	20	<5	—	—	—	<10	670	5	200	20	14,000	670
406	.19	60	<5	—	—	—	<10	2,330	<5	170	<10	—	40
678	13.9	40	10	—	125	—	<10	100	—	10	20	120	20
140	<.02	60	8	—	—	—	<10	340	—	140	10	—	20
426	.04	70	<5	—	—	—	<10	1,690	—	840	10	—	90
182	.96	70	<5	—	—	—	<10	60	—	10	10	—	235
664	<.02	70	<5	—	890	—	<10	200	—	30	10	650	30
260	<.02	60	<5	—	—	—	<10	770	9	680	<10	—	242
318	<.02	80	—	—	—	—	<10	40	—	20	—	—	10
412	.04	—	—	—	—	—	10	330	6	300	20	—	250
246	.46	140	—	—	—	—	10	120	9	30	20	—	1,160
164	.24	2,620	—	—	—	—	—	320	16	30	10	—	250
186	.22	240	—	—	—	—	—	540	—	30	—	—	270
6,100	<.02	160	—	98,000	—	—	—	800	—	60	30	80,000	40
680	1.18	920	—	—	—	—	10	50	—	20	—	—	1,230
216	<.02	1,300	—	—	—	—	—	40	—	—	—	—	80
266	<.02	370	—	—	—	—	—	140	—	50	—	—	274
282	<.02	50	<5	—	—	—	<10	320	—	100	<10	—	280
298	<.02	340	—	—	—	—	<10	10	—	420	10	—	302
246	<.02	110	—	—	—	—	10	980	—	250	30	—	10
512	<.02	200	—	—	—	—	—	1,400	20	2,600	20	—	316
266	<.02	—	9	—	—	—	—	15,900	—	410	20	—	318
132	<.02	630	8	—	—	—	—	340	—	90	—	—	10
162	.04	90	25	—	—	—	—	820	—	240	—	—	357
202	<.02	140	—	—	—	—	—	230	—	140	—	—	376
224	<.02	150	22	—	—	—	—	690	—	50	—	—	377
202	.18	240	<4	194	—	—	<10	50	—	10	26	1,580	20
146	.51	150	<4	140	—	—	<10	60	—	<10	49	<100	26
148	2.86	<130	<4	45	—	—	<10	5,350	50	<10	<25	<100	<10
438	.46	80	<5	—	—	—	<1	10	500	—	130	10	10
470	—	370	—	—	—	—	—	500	—	20	—	—	435
186	1.40	—	—	—	—	—	—	400	—	610	—	—	496
100	.12	2,000	—	—	—	—	—	2,400	7	120	—	—	528
124	2.38	3,800	—	—	—	—	—	5,600	—	110	—	—	529
284	2.40	<130	<1,000	76	—	<10	50	38	—	<10	<25	<100	67
220	<.02	70	<5	240	—	<1	10	120	—	180	20	210	10
134	.04	90	<5	<10	—	<1	10	30	—	<10	10	<10	20
538	6.38	50	<5	90	—	1	10	40	5	<10	20	90	30
244	<.02	70	11	170	—	<1	10	240	6	250	10	550	20
250	<.02	<100	26	340	—	<1	<70	2,500	<4	690	<140	520	10
142	.68	50	<5	30	—	1	20	370	5	<10	10	110	30
320	3.85	100	<4	80	—	<1	<10	<100	<4	<50	<140	110	30
344	.52	50	<5	200	—	<1	10	250	6	410	10	450	40
248	.02	90	<5	270	—	1	<10	1,710	6	220	20	420	20

Table

Well number	Date of collection	Aquifer <sup>1</sup>	pH (units)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Sodium, dissolved (mg/L)	Potassium, dissolved (mg/L)	Alkalinity (mg/L)	Sulfate, dissolved (mg/L)	Chloride, dissolved (mg/L)	F <sub>ri</sub> c <sub>so</sub> (π)
Br- 633	6/27/84	Qsd/u	7.9	62	12	26	1.4	180	37	35	<1
634	8/ 8/83	Qsd/u	7.1	71	12	33	1.2	180	30	121	<
637	7/12/84	Qsd/c	7.4	49	12	33	.90	214	10	—	
639	6/27/84	Dlh	7.7	46	10	38	1.5	182	57	<1.0	
643	6/27/84	Qsd/u	6.8	33	7.5	10	1.9	110	18	9.0	<
648	8/10/83	Qsd/u	7.1	38	8.1	6.1	.70	138	15	4.0	
650	8/ 9/83	Qsd/u	7.1	56	10	8.8	.88	152	25	33	
651	6/28/84	Qt	8.1	14	3.5	89	1.1	206	25	13	
652	8/ 9/83	Qsd/u	7.2	53	9.9	8.3	.78	154	25	28	
655	7/23/84	Qt	8.0	36	12	20	1.2	170	17	2.0	
657	7/10/84	Qsd/c	6.5	26	5.3	2.1	1.0	62	20	—	<
659	7/11/84	Qt	6.6	26	3.8	33	.80	62	10	—	<
663	7/12/84	Qsd/u	6.6	26	6.7	7.1	.90	74	20	—	<
664	8/10/83	Qsd/c	7.2	50	11	103	1.2	228	10	224	
666	8/16/83	Qsd/c	6.2	16	4.2	6.1	.56	52	25	2.0	<
672	8/22/83	Dlh	8.6	8.2	2.4	165	1.1	292	40	132	
673	7/12/84	Qsd/u	7.4	48	10	11	1.0	138	10	—	<
675	7/23/84	Qt	8.0	48	4.0	5.3	.80	110	31	7.0	
677	7/24/84	Qsd/u	8.0	30	4.5	17	.50	94	21	3.0	
684	8/17/83	Qsd/u	6.4	39	7.0	3.9	1.1	110	30	6.0	<
686	8/17/83	Qsd/c	6.9	32	5.4	11	1.4	124	20	2.0	<
687	7/24/84	Qsd/u	7.1	16	3.5	3.4	1.3	46	21	1.0	
689	7/24/84	Qsd/u	7.8	28	6.4	57	.90	158	17	37	
691	7/25/84	Qsd/u	8.1	33	6.1	61	.40	166	14	37	
692	8/17/83	Dlh	6.7	32	5.8	4.9	.58	88	25	6.0	
694	8/23/83	Qsd/c	8.1	31	5.5	4.2	.76	86	27	5.0	
695	7/ 5/84	Qsd/c	8.1	39	8.2	90	2.0	196	11	125	
697	7/25/84	Qsd/u	6.6	13	2.3	5.2	.70	20	23	8.0	
700	8/17/83	Dlh	7.0	28	5.7	16	.84	104	25	6.0	
703	8/ 1/84	Qsd/u	8.1	56	15	61	1.3	266	77	3.0	
705	8/ 1/84	Qt	7.8	40	8.6	7.5	1.1	118	29	6.0	
707	8/ 1/84	Qt	7.9	49	13	8.6	1.3	156	29	2.0	
710	8/17/83	Dlh	6.6	20	4.5	19	.58	102	10	7.0	
713	8/ 1/84	Qt	8.3	33	11	252	2.3	208	22	336	
715	8/ 1/84	Qt	7.7	60	16	18	1.4	216	43	2.0	
721	8/ 7/84	Qsd/u	7.5	41	19	4.8	6.0	66	29	8.0	
723	8/ 7/84	Qsd/u	8.0	55	4.7	5.2	1.1	118	26	13	
726	8/16/83	Qsd/c	6.8	33	5.8	29	.70	102	25	40	
732	8/22/83	Qsd/u	6.6	21	6.1	8.1	3.2	52	21	15	
747	4/28/86	Qsd/u	7.9	95	12	23	1.7	188	39	71	
752	8/23/83	Qt	8.2	25	6.0	211	3.1	258	11	319	
757	6/27/84	Qsd/u	7.5	36	8.1	16	.70	140	18	4.0	
764	6/13/84	Qsd/c	8.0	55	12	12	1.0	192	26	2.0	
766	6/13/84	Dlh	6.8	41	9.2	8.2	1.1	90	50	11	
767	6/13/84	Qsd/c	7.7	86	20	19	1.1	224	50	33	
768	7/10/84	Qsd/c	7.2	199	39	86	1.8	308	30	—	
779	6/28/84	Qsd/c	7.9	48	11	8.0	.90	150	50	10	
806	7/17/84	Qsd/u	7.1	14	4.3	4.6	.40	56	25	3.0	
807	7/17/84	Qsd/u	7.0	21	7.0	8.8	.80	74	33	11	
808	10/10/85	Qsd/c	7.7	67	10	8.1	.65	142	26	32	
809	10/29/85	Qsd/u	6.7	47	7.7	7.7	.71	90	24	26	
810	10/30/85	Qsd/c	7.4	74	13	9.1	.70	152	41	38	
PO <sub>4</sub>											
Po- 39	5/14/65	Dck	6.8	14	5.4	—	—	11	17	23	
76	3/ 3/61	Dck	7.3	—	—	—	—	46	—	670	
135	7/14/81	Dlh	7.2	28	9.8	9.0	1.4	118	31	4.0	
136	7/14/81	Dck	7.5	23	6.0	2.0	.88	72	24	5.0	



Table 20.

Well number	Date of collection	Aquifer <sup>†</sup>	pH (units)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Sodium, dissolved (mg/L)	Potassium, dissolved (mg/L)	Alkalinity (mg/L)	Sulfate, dissolved (mg/L)	Chloride, dissolved (mg/L)	Fluoride, dissolved (mg/L)
Po-141	7/15/81	Dck	6.9	26	9.6	3.5	1.4	88	33	3.0	<0.10
148	7/15/81	Dck	6.9	12	3.7	7.8	1.2	48	26	2.0	.10
167	7/15/81	Dck	7.4	28	4.9	5.0	1.1	102	17	1.0	<.10
168	7/15/81	Dck	7.6	49	29	28	3.0	218	95	9.0	.14
169	7/15/81	Dck	6.6	9.2	1.6	1.4	.80	24	26	1.0	<.10
175	4/28/86	Dck	7.4	35	8.7	316	4.1	100	<10	687	.30
176	7/24/85	Dlh	7.7	48	29	19	1.9	208	40	6.0	.12
177	7/24/85	Dlh	7.9	38	21	17	2.1	172	24	4.0	.12
180	7/24/85	Dlh	8.1	9.8	4.5	109	1.5	158	<10	103	.24
182	7/24/85	Dlh	8.1	15	5.3	104	1.8	158	<10	113	.32
183	7/24/85	Dlh	8.0	41	21	26	2.3	190	27	6.0	.20
184	7/24/85	Dlh	7.9	43	25	23	1.9	206	41	6.0	.19
186	7/15/81	Dlh	7.7	40	21	12	1.8	190	34	4.0	.11
226	7/18/85	Dck	7.6	44	12	125	2.0	96	10	245	.10
227	7/18/85	Dck	7.1	31	10	26	1.4	60	<10	87	.10
230	7/17/85	Dck	5.8	3.4	1.3	.51	.73	8	<10	2.0	.10
232	8/7/85	Qsd/u	6.3	17	3.8	12	.58	50	<10	25	<.10
233	8/7/85	Qsd/u	6.4	19	3.7	13	.65	54	<10	27	<.10
234	8/7/85	Qsd/u	6.3	12	4.3	4.9	.49	40	<10	15	<.10
235	8/7/85	Dch	6.2	7.7	3.2	1.9	.46	32	<10	4.0	<.10
236	8/7/85	Qsd/c	6.1	6.6	3.4	8.9	.64	18	<10	8.0	<.10
237	8/7/85	Dch	8.0	3.3	.98	99	.27	204	<10	46	.46
238	8/7/85	Dlh	6.2	7.5	3.1	2.8	.42	30	<10	9.0	<.10
239	8/8/85	Qsd/u	6.0	10	5.2	6.3	1.4	16	<10	21	<.10
240	8/8/85	Qsd/u	6.2	16	5.0	9.1	.61	30	<10	37	<.10
247	8/21/85	Dck	6.8	17	.68	8.8	.68	90	<10	3.0	.10
248	8/21/85	Dck	6.9	22	8.8	8.4	1.0	104	<10	4.0	.10
249	8/22/85	Qsd/u	7.0	15	5.8	40	.78	142	<10	18	.22
250	8/22/85	Dck	6.9	22	8.4	7.8	.82	110	<10	2.0	.17
251	8/22/85	Dlh	7.2	14	5.6	41	.81	150	<10	11	.24
259	7/17/85	Dck	6.4	16	4.3	11	.86	54	<10	17	<.10
262	7/18/85	Dck	6.9	16	6.8	4.4	.71	62	<10	10	<.10
263	7/18/85	Dck	8.1	51	14	318	4.1	138	<10	609	.14
264	7/18/85	MDhm	6.9	10	2.9	2.4	.81	36	<10	6.0	<.10
266	7/24/85	Dlh	7.8	48	28	18	1.9	216	39	4.0	.19
267	7/24/85	Dlh	7.9	46	26	23	1.97	206	41	6.0	.19
268	7/25/85	Dck	7.0	12	2.9	2.5	.68	34	<10	2.0	<.10
269	7/25/85	Qsd/u	6.4	21	5.2	4.6	.81	52	<10	10	<.10
272	7/25/85	Dck	6.5	15	4.7	3.9	.67	56	<10	2.0	<.10
274	7/18/85	Dck	7.3	15	5.2	7.6	1.1	132	10	3.0	<10
TIOGA											
Ti- 1	5/22/74	Qsd/u	9.5	22	3.2	17	12	39	23	25	.10
4	8/20/35	Dck	—	56	9.8	—	—	139	15	300	—
12	3/26/74	Dlh	7.5	—	—	—	—	181	—	120	.20
16	3/27/74	Qsd/c	7.5	—	—	—	—	124	—	21	.10
43	8/19/35	Qsd/u	—	64	12	8.9	1.6	168	46	6.5	—
47	8/19/35	Dlh	—	82	17	—	—	162	7.0	1,820	—
52	8/19/35	Qsd/c	—	75	20	—	—	216	2.0	465	—
56	7/ 9/85	Qsd/c	7.7	57	6.2	5.9	.74	102	32	32	.16
66	2/ 6/73	Qsd/c	7.1	—	—	—	—	106	—	11	.10
71	8/21/35	Dck	—	26	4.8	—	—	90	13	14	—
100	10/ 8/75	Dlh	6.8	64	8.0	9.9	1.5	135	22	43	.10
102	10/23/79	Qsd/u	7.8	53	7.0	5.2	1.1	150	13	2.7	.20
103	10/23/79	Qsd/u	7.2	55	7.5	6.0	3.9	150	24	6.1	.50
104	10/24/79	Qsd/u	7.3	34	6.5	4.9	2.5	99	8.8	9.4	.40
105	10/24/79	Qsd/u	7.9	63	13	14	3.3	210	31	12	.10
107	4/29/86	Dlh	7.4	17	3.6	78	2.8	120	16	82	.20



Table 20.

Well number	Date of collection	Aquifer <sup>1</sup>	pH (units)	Calcium, dis- solved (mg/L)	Magne- sium, dis- solved (mg/L)	Sodium, dis- solved (mg/L)	Potas- sium, dis- solved (mg/L)	Alka- linity (mg/L)	Sulfate, dis- solved (mg/L)	Chlo- ride, dis- solved (mg/L)	Fluo- ride, dis- solved (mg/L)
Ti-108	10/23/79	Dlh	7.5	7.4	12	6.7	1.9	76	1.6	2.3	0.10
109	10/23/79	Qsd/u	7.0	64	7.9	13	3.4	230	11	4.7	.20
110	10/23/79	Qsd/u	6.9	180	47	26	9.1	610	1.0	18	.10
145	2/26/75	Qsd/u	6.6	—	—	—	—	42	57	26	.10
146	8/10/72	Qsd/u	6.2	—	—	—	—	42	59	28	.10
151	8/28/74	Qsd/c	7.7	—	—	—	—	186	30	21	.10
153	2/27/75	Qsd/c	7.4	42	19	—	—	156	80	9.7	.10
173	7/20/81	Qt	6.8	63	18	43	.82	244	15	27	.16
186	7/ 7/81	Dck	8.1	22	7.3	109	2.9	208	5.0	77	.19
191	7/13/81	Qsd/u	6.8	25	4.4	5.9	.90	72	31	13	.10
216	7/ 9/85	Qsd/c	7.7	15	3.4	2.4	.60	100	33	35	.10
234	7/20/81	Dlh	7.4	31	12	92	2.5	194	36	66	.26
242	7/21/81	Dck	7.5	42	5.6	7.1	.96	130	5.0	4.0	.15
246	7/21/81	Dlh	7.6	31	12	77	2.2	232	5.0	40	.23
252	7/21/81	Dlh	7.2	30	6.9	66	2.2	202	5.0	25	.23
253	7/21/81	Dlh	7.0	39	8.4	69	2.6	228	5.0	42	.17
254	7/21/81	Qsd/c	6.7	51	12	47	2.1	256	20	5.0	.11
257	7/21/81	Dck	8.0	25	3.9	170	3.0	118	15	240	.26
258	7/21/81	Dck	7.0	9	3.8	93	3.3	192	25	17	.39
259	7/21/81	Qsd/c	6.3	29	3.7	22	1.4	102	5.0	22	.18
262	7/22/81	Dlh	6.9	41	12	137	4.5	292	25	76	.19
264	7/22/81	Qsd/u	6.6	36	6.8	3.6	1.9	90	10	2.0	.12
272	8/28/85	Qsd/u	6.1	7.4	1.5	.89	.48	20	10	1.0	.10
284	7/21/81	Qt	7.6	57	21	41	1.3	256	30	17	.11
285	7/21/81	Dlh	7.7	63	14	29	2.7	238	20	4.0	.13
294	4/28/86	Dlh	8.0	15	3.3	442	4.1	326	10	566	.60
316	7/28/81	Qsd/u	7.5	24	2.5	2.4	.90	64	5.0	2.0	.56
383	7/28/81	Dlh	7.3	61	9.0	27	2.4	138	20	50	.22
393	8/ 4/81	Dck	6.8	42	3.3	4.1	.64	88	15	13	.13
396	8/ 4/81	Dck	7.3	42	2.6	31	.74	102	5.0	22	.10
399	7/10/85	Qsd/u	6.3	26	6.4	5.7	.89	38	47	23	.10
401	11/ 7/83	Qsd/u	6.2	64	11	79	10	82	65	214	.10
433	7/27/83	Dlh	7.1	67	11	19	2.9	202	53	16	.10
434	7/27/83	Qsd/u	6.1	39	7.4	3.6	1.8	46	33	8.0	.10
445	4/28/86	Qt	6.9	35	7.7	21	2.2	120	10	44	.20
448	8/ 8/84	Qsd/u	7.9	69	5.5	6.7	1.2	154	35	18	.10
449	8/ 8/84	Qsd/u	8.0	63	6.2	6.6	1.4	150	29	8.0	.10
450	8/14/84	Qt	8.1	34	7.3	35	1.5	122	14	50	.10
454	8/14/84	Qt	8.0	50	17	35	1.9	236	44	2.0	.12
456	8/13/84	Qsd/u	7.8	37	4.9	4.0	1.4	78	38	3.2	.10
459	8/14/84	Qsd/u	7.7	37	6.0	8.9	1.7	100	21	14	.10
470	11/12/85	Qsd/u	6.4	12	2.1	1.4	.82	24	10	4.0	.10
471	11/12/85	Qsd/u	6.3	6.1	1.4	1.3	.79	12	10	4.0	.10
479	6/ 6/84	Dck	6.3	15	2.8	7.1	1.0	28	25	2.0	.10
482	6/ 6/84	Dlh	6.7	7.0	1.4	1.1	.60	18	25	1.0	.10
485	9/12/85	Qsd/u	5.9	6.2	1.5	.20	.33	14	10	3.0	.10
486	11/12/85	Dck	7.4	35	6.3	176	3.9	76	10	304	.17
498	8/ 1/84	Dlh	7.7	97	17	128	3.6	162	91	193	.14
511	7/24/85	Qsd/c	6.8	48	6.7	6.1	.95	108	39	10	.10
512	7/31/85	Qsd/c	6.3	28	6.7	4.0	.57	66	42	17	.10
515	7/10/85	Dlh	7.2	34	12	27	.90	178	37	9.0	.16
516	7/10/85	Qsd/u	6.9	32	3.6	3.2	.54	74	41	5.0	.10
517	7/10/85	Qsd/c	7.2	45	5.9	9.6	.76	140	42	12	.16
518	7/10/85	Qsd/u	7.1	34	7.7	5.5	.71	108	42	3.0	.10
534	8/ 8/84	Qsd/c	8.0	47	5.1	6.3	1.1	110	29	14	.10

<sup>1</sup>Qsd/u, stratified drift/unconfined; Qsd/c, stratified drift/confined; Qt, till; MDhm, Huntley Mountain Formation; Dch, Chadakoin Formation; Dck, Catskill Formation; Dlh, Lock Haven Formation.

<sup>2</sup>ND, not detected; detection limit unknown.

(Continued)

Dis-solved solids (mg/L)	Nitrate, dis-solved as N (mg/L)	Alu-minum, dis-solved (µg/L)	Arsenic, dis-solved (µg/L)	Barium, dis-solved (µg/L)	Cad-mium, dis-solved (µg/L)	Chro-mium, dis-solved (µg/L)	Iron, dis-solved (µg/L)	Lead, dis-solved (µg/L)	Manga-nese, dis-solved (µg/L)	Nickel, dis-solved (µg/L)	Stron-tium, dis-solved (µg/L)	Zinc, dis-solved (µg/L)	Well number
—	—	20	1	10	2	1	30	2	70	3	9	20	Ti-108
—	—	100	3	100	2	1	2,400	2	4,300	6	170	10	109
—	—	100	4	400	3	1	12,000	7	780	12	640	180	110
—	—	—	—	200	3	<20	120	5	50	—	—	130	145
—	—	—	—	—	—	—	<10	—	10	—	—	—	146
—	—	—	—	—	—	—	1,930	—	320	—	—	—	151
—	—	—	—	—	50	ND	ND	70	ND	150	—	250	153
296	0.02	80	<4	<4	—	<1	<10	390	<5	1,470	20	20	173
378	.02	90	<4	<4	—	<1	—	30	<5	40	10	10	186
138	<.02	90	<4	<4	—	<4	<10	7,910	<50	100	20	2,270	191
170	.18	<40	<500	—	100	<10	<50	34	<45	<10	<25	57	91
328	.04	80	<4	<4	—	<1	20	170	<5	30	<10	—	30
166	.44	30	<4	<4	—	<1	<10	60	<5	30	<10	—	242
310	.02	90	<4	<4	—	<1	<10	670	<5	140	<10	—	20
260	.02	60	46	—	—	<1	20	720	14	50	20	—	252
300	.02	40	35	—	—	<1	<10	680	5	30	10	—	253
306	.02	40	<4	—	—	<1	<10	880	<5	360	<10	—	70
638	.02	60	5.3	—	—	<1	<10	690	<5	90	10	—	257
258	.01	30	<4	<4	—	<1	10	80	<5	20	10	—	258
138	.02	30	<4	<4	—	<1	30	650	<5	80	10	—	60
318	.02	60	<4	<4	—	<1	<10	220	<5	20	<10	—	30
216	.58	10	<4	<4	—	<1	<10	570	<5	10	<10	—	60
76	.18	76	<1,000	—	13	<10	<50	156	<45	<10	<25	<10	<10
284	.02	50	<4	<4	—	<1	10	2,400	<5	1,160	—	—	284
292	.02	180	<4	<4	—	<1	10	2,440	<5	710	<10	—	285
1,060	.01	<130	<4	<4	1,200	<10	<50	265	<50	26	<25	440	786
106	.20	80	11	—	—	<1	<10	110	<5	10	20	—	316
376	.78	90	<4	<4	—	<1	10	30	<5	20	10	—	383
152	.55	80	5	—	—	1	10	210	42	1,030	20	—	1,620
144	1.27	100	<4	<4	—	<1	10	30	<5	110	20	—	396
238	7.26	<40	<1,000	—	31	<10	<50	30	<45	<10	<25	35	156
624	7.04	80	<4	<4	120	1	20	4,530	8	590	40	70	401
296	.12	70	<4	<4	30	1	10	820	<5	520	30	670	433
102	1.26	50	<4	<4	50	3	10	250	5	50	30	40	2,060
224	.12	136	23	1,380	<10	<50	286	114	314	59	1,000	21	445
258	<.02	<100	<4	<4	90	<1	<70	630	<4	—	<140	—	448
226	<.02	<100	<4	<4	180	<1	<70	330	<4	9	<140	250	10
252	<.02	100	<4	<4	190	<1	<70	350	<4	60	<140	200	110
318	2.75	100	<4	<60	<1	<70	1,500	<4	390	<140	250	80	454
194	1.98	100	<4	<60	<1	<70	210	<4	<50	<140	150	50	456
206	2.52	<100	<4	<60	<1	<70	100	4	<50	<140	90	80	459
42	.64	<40	<1,000	—	30	<10	<50	113	<45	<10	<25	25	<10
106	.26	215	<1,000	—	31	<10	<50	114	<45	<10	<25	<10	471
106	1.64	150	<4	<4	80	<1	<70	1,620	10	80	<140	40	20
52	.04	<150	<4	<4	60	<1	<70	1,120	<4	<50	<140	30	570
62	.34	<40	<1,000	—	<10	<10	<50	173	<45	<10	32	<10	33
588	<.04	<40	<1,000	2,100	<10	<50	864	<45	52	<25	1,735	<10	486
830	.08	100	<4	<4	2,200	2	<70	740	<4	1,020	<140	1,600	30
234	.16	<40	<1,000	—	106	<10	<50	2,920	<45	6,070	<25	<10	511
234	3.08	<40	<1,000	—	48	<10	<50	6,650	<45	366	<25	<10	53
244	<.04	<40	<1,000	—	176	<10	<50	545	<45	1,035	<25	218	<10
148	2.86	<40	<1,000	—	30	<10	<50	328	<45	<10	<25	41	15
222	<.04	<40	<1,000	—	693	<10	<50	351	<45	136	<25	116	<10
160	.56	<40	<1,000	—	187	<10	<50	96	<45	<10	<25	209	<10
206	<.02	100	4	150	<1	70	590	4	290	140	280	10	534

Table 21. Record of

**Well location:** The number that is assigned by the U.S. Geological Survey to identify the well or test hole. It is prefixed by the two-letter abbreviation of the county. The lat-long is the latitude and longitude in degrees, minutes, and seconds, of the location of the well or test hole. Wells and test holes are shown on Plates 1A and 1B.

**Type of completion:** O, open end; P, slotted; S, screen; T, well point; W, dug; X, open hole.

**Use:** A, air conditioning; B, bottling; C, commercial; H, domestic; I, irrigation; N, industrial; O, observation; P, public; S, stock; T, test; U, unused; Z, other.

Well location			Driller	Year completed	Type of completion	Use
Number	Lat-Long	Owner				
<b>BRADFORD</b>						
Br- 5	414608-762713	Towanda Borough	—	—	X	P
6	414605-762714	do.	—	—	X	P
7	414550-762632	Patterson Screen Co.	J. F. Yarrison	—	X	N
9	414709-762639	GTE Sylvan	—	1935	S	N
10	414647-763629	Morse, A.	Leon Wood	—	O	H
19	414626-764720	Troy Dairy Farm	do.	—	X	N
20	414649-764722	Borden Co. of Pennsylvania	—	—	X	N
21	414649-764722	do.	Leon Wood	—	X	N
22	414701-764717	Troy Engine and Machine	do.	—	X	C
27	415000-764805	Dairymen's League Coop.	—	1935	—	U
31	415146-763750	East Smithfield Creamery	—	—	X	N
32	415145-763753	East Smithfield Farms	Leon Wood	—	X	N
33	415058-762957	Sheffield Farms	do.	—	S	N
34	415057-762958	do.	—	—	X	N
36	414910-762622	Kilmus, F.	Frank Strum	1934	X	H
37	415119-762930	Sheshequin School	—	1934	O	H
40	415407-761816	Phillips, L.	—	1934	O	H
41	415500-761840	Crowleys Milk Co., Inc.	—	—	X	N
42	415617-761504	do.	—	—	X	N
43	415615-761504	do.	—	—	X	N
46	415844-763049	Sayre Brewing Co.	—	—	X	N
47	415757-763111	Pure Ice Co.	—	—	O	N
48	415738-763129	Dairymen's Coop. Assoc.	—	—	O	N
59	413955-765109	Sheffield Farms	—	—	X	N
60	413905-765103	Rosedale Dairy	Leon Wood	1931	O	N
61	413908-765057	Belmar Mfg. Co.	do.	—	O	N
62	413818-765217	Dairymen's Coop. Assoc.	—	—	X	N
63	413653-765204	Sheffield Farms	—	1910	X	N
69	414303-764647	do.	Leon Wood	1913	X	N
75	413951-761604	Dairymen's Coop. Assoc.	—	—	X	N
79	414532-761038	Stevensville High School	Scanlin Bros.	1931	X	P
83	414608-762451	Standard Oil Co.	H. W. Brown	1932	X	H
84	414621-762405	Sheffield Farms	—	1935	—	N
85	414617-762405	do.	—	1916	X	N
89	414554-762455	Masonite Corp.	Layne-New York Co., Inc.	1964	S	N
90	414542-762523	do.	do.	1966	S	N
92	414330-762805	U.S. Geological Survey	Joseph W. Cummings and Son	1966	X	O
97	414710-762732	Dupont and Co.	The Lauman Co., Inc.	1949	—	N
98	414705-762733	do.	do.	1949	S	N
99	414702-762731	do.	do.	1949	X	N
100	414706-762728	do.	do.	1949	S	N
102	414705-762726	do.	Sprague and Henwood, Inc.	1940	S	N
106	413653-765205	H. E. Koontz Creamery	J. F. Yarrison	—	X	N
107	413653-765205	do.	do.	—	—	N

## Wells and Test Holes

Aquifer: Qsd/u, stratified drift/unconfined; Qsd/c, stratified drift/confined; Qt, till; Ql, lacustrine deposits; Qs, swamp deposits; MDhm, Huntley Mountain Formation; Dch, Chadakoin Formation; Dck, Catskill Formation; Dlh, Lock Haven Formation.

Water level: F, flows at the land surface, but the head is not known. A negative number indicates that the head is above the land surface.

Reported yield: gal/min, gallons per minute.

Hardness: Field determination, in grains per gallon, converted to mg/L by multiplying by 17.1 and rounding to the nearest 5 mg/L.

Specific conductance:  $\mu\text{mho}/\text{cm}$  at 25°C, micromhos per centimeter at 25 degrees Celsius.

Altitude of land surface (feet)	Aquifer	Depth of well (feet)	Water level						Well number	
			Casing		Depth below land surface (feet)	Date measured (mo/yr)	Reported yield (gal/min)	Specific conductance ( $\mu\text{mho}/\text{cm}$ )	Hardness, as $\text{CaCO}_3$ (mg/L)	
COUNTY			Depth (feet)	Diameter (inches)						
860	Dlh	340	—	6	—	5/34	50	—	—	Br- 5
860	Dlh	353	—	10	—	—	25	—	—	6
740	Dlh	720	40	6	24	1/35	38	—	—	7
740	Qsd/u	62	62	10	43	7/35	350	360	195	9
900	Qsd/u	42	—	6	12	—	8	—	—	10
1,150	Dck	100	90	6	-5	—	20	—	—	19
1,140	Dlh	300	100	6	-2	8/35	130	—	—	20
1,140	Dlh	207	100	8	-1	—	40	—	—	21
1,140	Dlh	412	75	8	60	—	20	—	—	22
1,140	Qt	150	150	—	55	—	18	—	—	27
1,230	Dck	202	100	8	F	—	17	—	—	31
1,220	Dck	230	100	8	F	8/35	85	—	—	32
750	Qsd/u	32	22	6	15	1/35	—	—	—	33
750	Dlh	200	99	8	30	—	25	—	—	34
1,240	Dlh	185	137	6	22	8/34	5	—	—	36
740	Qsd/u	55	55	6	35	9/34	45	—	—	37
1,180	Qt	134	134	6	50	8/34	30	—	—	40
1,040	Dlh	100	40	5	6	8/35	20	—	—	41
1,070	Dlh	118	30	8	F	1/35	40	—	—	42
1,070	Dlh	36	30	6	8	1/35	40	—	—	43
780	Qsd/c	90	90	6	31	—	27	—	—	46
770	Qsd/u	44	44	8	27	7/31	160	—	350	47
780	Qsd/u	40	40	6	20	1/35	60	—	—	48
1,280	Dlh	201	40	8	25	—	40	—	—	59
1,140	Qsd/c	175	175	6	11	1/32	45	—	150	60
1,150	Qsd/c	160	160	6	8	1/35	32	—	—	61
1,200	Dlh	295	67	8	60	1/35	40	—	—	62
1,260	Dlh	105	—	6	—	—	50	—	—	63
1,360	Dlh	159	40	6	8	1/13	40	—	—	69
680	Dck	150	100	6	40	8/35	48	—	—	75
800	Dck	138	—	6	—	—	15	—	—	79
720	Dlh	140	50	6	2	1/32	30	—	—	83
710	Qsd/u	38	12	—	35	1/35	180	—	—	84
720	Dlh	600	—	6	50	1/16	50	—	270	85
720	Qsd/u	80	—	—	—	—	350	—	—	89
750	Qsd/u	80	—	—	—	—	—	—	—	90
750	Dlh	117	55	6	8	5/66	40	1,000	35	92
790	Dlh	70	—	—	69	9/49	—	—	—	97
780	Qsd/u	104	84	12	85	8/83	40	—	—	98
780	Qt	67	—	—	—	—	—	—	—	99
790	Qsd/u	130	104	12	87	7/75	200	—	—	100
800	Qsd/u	96	90	8	83	7/46	350	—	—	102
1,230	Dlh	—	—	—	—	—	160	—	—	106
1,230	Qsd/u	49	—	—	5	—	220	—	—	107

Table 21.

Well location			Driller	Year completed	Type of completion	Use
Number	Lat-Long	Owner				
Br-108	415750-763120	Ingersoll-Rand Co.	Layne-New York Co., Inc.	1949	S	N
109	414625-763724	Bradford County Home	N. W. Brown	1948	O	P
110	413958-761558	Wyalusing Borough	Clarence W. Crandall	1950	X	P
111	413952-761558	do.	—	1937	X	P
112	413947-761533	Wells Mills Co.	N. W. Brown	1952	X	P
113	414706-764913	Troy Borough	Donald K. Havens	1958	X	P
114	414708-764914	do.	do.	1958	X	P
115	414704-764744	do.	—	1913	X	P
120	414709-762639	GTE Sylvania	J. F. Yarrison	1940	S	N
121	413554-762638	New Albany Borough Water Fund	—	1953	X	P
124	413927-765018	Canton Borough Authority	Layne-New York Co., Inc.	1968	S	P
125	415558-764806	Maynard, L.	W. H. Vanderhoof Drilling Co.	1977	—	H
132	415910-764627	Kress, D.	Donald K. Havens	1980	X	H
134	413733-765205	Palmer, R.	William S. Kuser	1980	O	S
137	413917-765009	Griffin, J.	do.	1980	X	H
150	415904-764743	Culver, M.	W. H. Vanderhoof Drilling Co.	1980	O	H
151	413658-765212	Terry, R.	William S. Kuser	1980	—	H
152	413647-765130	Hickok, J.	do.	1980	—	H
155	414720-762647	GTE Sylvania TW6	Germania Well Drilling Co.	1967	O	T
156	414706-762639	GTE Sylvania TW9	—	1973	O	T
157	414705-762642	GTE Sylvania TW10	—	1975	O	T
158	414716-762747	GTE Sylvania TW11	Willard S. Kuser	1978	O	T
161	415604-764840	Avery, R.	W. H. Vanderhoof Drilling Co.	1977	O	H
163	415155-764901	Chamberlain, H.	Donald K. Havens	1980	X	H
167	413407-761423	Tuttle, R.	Stanley Thomas	1979	—	H
171	413657-761421	Burke, L.	Joseph W. Cummings and Son	1977	—	H
185	415217-764331	Lee, T.	W. H. Vanderhoof Drilling Co.	1976	X	H
187	415625-764255	Squires, R.	do.	1977	—	H
188	415522-764401	May, M.	do.	1978	X	H
191	415629-764340	Carr, E.	do.	1979	X	H
201	414823-764019	Mt. Pisgah State Park	Harrisburg's Kohl Bros.	1977	X	P
202	414815-763918	do.	do.	1977	X	P
205	414548-764518	Earle, R.	Donald K. Havens	1980	X	S
206	414623-764356	Van Noy, G.	Dan Burgess	1978	X	H
209	414533-764217	Bronson, J.	Donald K. Havens	1980	X	S
211	415151-763739	Detnold, C.	W. H. Vanderhoof Drilling Co.	1979	X	H
212	415142-763848	Kingsley, D.	do.	1980	O	H
214	415158-763803	Long, M.	do.	1979	O	H
221	415746-763119	Ingersoll-Rand Co.	Layne-New York Co., Inc.	1960	S	A
226	415632-763042	Sayre Water Co.	do.	1972	—	P
227	415620-763024	do.	W. H. Vanderhoof Drilling Co.	1967	S	P
228	415933-763250	Proctor, D.	do.	1978	X	H
229	415859-763237	Meyers, M.	do.	1979	O	H
230	415841-763236	Loomis, D.	do.	1979	O	H
231	415825-763049	Sayre Little League	do.	1979	O	P
232	415909-763330	McCarty, B.	do.	1978	O	H
233	415842-763500	Benjamin, S.	James C. Vanderhoof	1979	X	H
235	415649-763309	Zosh, A.	W. H. Vanderhoof Drilling Co.	1977	O	H
236	415649-763305	Johnson, R.	do.	1976	X	H
237	415424-763140	Vincent, R.	do.	1978	O	H
238	415447-763223	Viselli, J.	do.	1980	X	H
239	415351-763407	Harvey, H.	do.	1978	X	H
241	415519-763513	Rosh, T.	do.	1980	O	H
242	415521-763642	Kellogg, C.	do.	1979	O	H
244	415525-763147	Keiper, H.	do.	1980	O	H



Table 21.

Well location			Driller	Year completed	Type of completion	Use
Number	Lat-Long	Owner				
Br-249	414123-760756	Culver, D.	Stanley Thomas	1979	X	H
250	414132-761352	Roberts, J.	Bell Brothers Drilling	1980	X	S
255	414533-761042	Learn, M.	Jimcon Drilling	1977	X	H
256	413634-762655	Capwell, J.	Robert F. Sanders	1979	X	H
258	414542-761028	Vandermark, L.	Jimcon Drilling	1978	X	H
265	414709-764725	Troy Borough	Donald K. Havens	1975	S	P
266	414706-764722	do.	do.	1974	S	P
270	414419-762129	Stevens, N.	Joseph W. Cummings and Son	1980	X	H
271	414451-761820	Schneider, C.	Anthony P. Tomsic	1980	X	H
272	414029-761624	Franklin, L.	Joseph W. Cummings and Son	1977	X	H
273	414233-761855	Cole, V.	Anthony P. Tomsic	1977	X	H
274	414151-761847	Darnell, C.	do.	1978	X	H
275	414012-761647	Smiley, J.	Joseph W. Cummings and Son	1977	X	H
281	415530-761422	Jersey Engine	Joseph W. Talcott	1978	O	N
282	415527-761412	Hicks, H.	do.	1978	O	H
283	415245-761404	Histand, B.	Joseph W. Cummings and Son	1978	X	H
284	415256-761357	Edsell, E.	do.	1980	O	H
285	415253-761357	Young, J.	do.	1980	O	H
292	415242-761122	Geiger, C.	Joseph W. Talcott	1980	X	H
293	415446-761119	Kotch, C.	do.	1979	O	H
296	415602-761312	Allyn, A.	W. H. Vanderhoof Drilling Co.	1981	X	H
297	415933-761334	Race, M.	Joseph W. Talcott	1982	X	S
298	415817-761914	Yeagle, B.	James C. Vanderhoof	1977	X	H
299	415829-761757	Berry, W.	Joseph W. Cummings and Son	1977	X	H
300	415759-761656	Wheaton, W.	W. H. Vanderhoof Drilling Co.	1979	X	S
301	414552-752607	Issac, J.	Joseph W. Cummings and Son	1978	O	H
302	414547-762546	Wickwire Trucking	do.	1981	O	C
303	414619-762434	First Bank of Bradford	do.	1979	O	C
304	414546-762442	State Aggregates	Jimcon Drilling	1978	O	N
305	414635-762510	Warburton, W.	Joseph W. Cummings and Son	1979	X	H
306	414624-762417	Beers, W.	do.	1980	O	H
307	414643-762346	Wysox Presbyterian Church	Jimcon Drilling	1979	X	P
308	414639-762323	Smeck, H.	Joseph W. Cummings and Son	1982	X	H
309	414624-762420	Ennis, H.	W. H. Vanderhoof Drilling Co.	1982	O	H
310	414519-762301	Sullivan, J.	Joseph W. Cummings and Son	1979	O	H
311	414733-762300	Cook, R.	do.	1978	X	H
312	414746-762246	Lehto, G.	do.	1978	O	H
313	414748-762250	Donavan, C.	do.	1977	O	H
314	414744-762259	Neiley, J.	do.	1977	X	H
315	415210-762402	Landmesser, G.	do.	1978	X	H
316	415223-762402	Horton, H.	Anthony P. Tomsic	1981	X	H
318	415107-762925	Hill, C.	Joseph W. Cummings and Son	1979	O	H
319	415126-762929	Babcock, R.	James C. Vanderhoof	1979	O	H
321	414839-762913	Fenton, J.	W. H. Vanderhoof Drilling Co.	1979	X	H
322	414840-762917	O'Brien, W.	do.	1981	X	H
323	414924-762946	Pipher, M.	Joseph W. Cummings and Son	1979	X	H
324	414923-762842	Whipple, R.	do.	1979	X	H
325	414904-762841	Tuttle, R.	do.	1981	X	H
326	414831-762857	Nickleton, D.	do.	1981	X	P
327	414821-762830	Hill, C.	do.	1979	X	H
328	414818-762747	Izard, T.	do.	1980	X	H
332	414559-763244	Van Note, K.	Jimcon Drilling	1980	X	H
333	414655-763356	Slocum, G.	W. H. Vanderhoof Drilling Co.	1973	O	S
334	414703-763313	Allen, R.	do.	1980	X	H

(Continued)

Altitude of land surface (feet)	Aquifer	Depth of well (feet)	Water level								
			Casing		Depth below land surface (feet)	Date measured (mo/yr)	Reported yield (gal/min)	Specific conductance (μmho/cm)	Hardness, as CaCO <sub>3</sub> (mg/L)	Well number	
			Depth (feet)	Diameter (inches)							
830	Dck	245	54	6	55	7/82	35	620	35	Br-249	
770	Dck	187	137	6	—	—	20	4,800	495	250	
820	Dck	250	51	6	—	—	30	—	—	255	
1,260	Dck	140	105	6	34	7/82	25	250	105	256	
860	Dck	250	80	6	85	3/78	3	—	—	258	
1,100	Qsd/u	93	40	6	—	—	360	—	—	265	
1,100	Qsd/u	60	50	8	—	—	360	—	—	266	
710	Dlh	100	70	6	F	7/82	5	335	140	270	
710	Dlh	110	71	6	10	7/82	40	6,000	820	271	
820	Dck	220	33	6	—	—	10	720	220	272	
950	Dlh	230	41	6	90	5/77	40	400	155	273	
750	Dlh	250	63	6	60	7/82	10	520	105	274	
690	Dck	90	70	6	40	7/77	14	580	120	275	
1,130	Qsd/u	32	32	6	6	10/78	50	—	—	281	
1,110	Qsd/u	23	23	6	20	8/78	10	—	—	282	
1,360	Dlh	144	126	6	20	10/78	20	—	—	283	
1,280	Qt	40	40	6	15	10/80	20	—	—	284	
1,260	Qt	43	43	6	20	10/80	20	—	—	285	
1,580	Dlh	249	189	6	118	3/80	20	—	—	292	
1,590	Qt	71	71	6	9	8/79	22	—	—	293	
1,170	Qsd/u	57	57	6	30	1/81	20	405	—	296	
1,250	Dlh	240	60	6	160	3/82	15	—	—	297	
930	Dlh	74	37	6	—	—	10	—	—	298	
980	Dlh	181	108	6	47	10/77	4	—	—	299	
1,010	Dlh	115	67	6	31	10/79	19	—	—	300	
810	Qt	125	125	6	—	—	20	—	—	301	
740	Qsd/u	91	91	6	20	7/82	20	376	190	302	
710	Qsd/c	83	83	6	2	7/82	10	340	170	303	
730	Dlh	100	84	6	—	—	15	—	—	304	
820	Dlh	124	81	6	—	—	16	—	—	305	
710	Qsd/c	85	85	6	40	8/80	4	—	—	306	
720	Dlh	175	100	6	40	2/79	50	—	—	307	
710	Dlh	141	62	6	—	—	10	—	—	308	
710	Qsd/c	81	81	6	14	3/82	25	—	—	309	
730	Qsd/u	91	91	6	20	4/79	20	—	—	310	
790	Dlh	198	83	6	80	6/78	3	—	—	311	
750	Qsd/u	55	55	6	—	—	15	—	—	312	
750	Qsd/u	83	83	6	—	—	14	—	—	313	
790	Dlh	236	54	6	50	11/77	1	—	—	314	
1,040	Dlh	68	20	6	—	—	6	—	—	315	
1,050	Dlh	130	102	6	28	7/82	5	540	35	316	
750	Qt	94	94	6	10	7/82	5	385	170	318	
750	Qsd/u	34	34	6	15	4/79	10	—	—	319	
750	Dlh	74	56	6	17	9/79	6	—	—	321	
740	Dlh	64	62	6	16	1/81	10	—	—	322	
740	Dlh	84	60	6	25	4/79	10	—	—	323	
870	Dlh	124	11	6	15	3/79	7	—	—	324	
860	Dlh	72	67	6	22	8/81	20	—	—	325	
750	Dlh	98	62	6	25	7/81	50	—	—	326	
750	Dlh	147	55	6	40	4/79	13	—	—	327	
760	Dlh	98	58	6	—	—	10	—	—	328	
1,030	Dlh	300	130	6	—	—	2	—	—	332	
890	Qsd/c	141	141	6	38	2/73	12	—	—	333	
940	Dlh	187	17	6	47	7/80	3	—	—	334	

Table 21.

Well location				Year completed	Type of completion	Use
Number	Lat-Long	Owner	Driller			
Br-335	414658-763517	Winston, R.	James C. Vanderhoof	1978	X	H
337	414647-763625	Pepper, L.	Joseph W. Cummings and Son	1978	O	H
347	415031-763518	Jackson, R.	W. H. Vanderhoof Drilling Co.	1981	O	H
350	414200-763057	Lantz, W.	Joseph W. Cummings and Son	1979	X	H
351	414156-763220	Langan, L.	do.	1981	X	H
352	414214-763406	Franklindale Church	W. H. Vanderhoof Drilling Co.	1978	X	P
357	414307-764109	Baxter, L.	do.	1978	X	H
358	414304-764140	Martin, H.	do.	1979	X	S
359	414307-764146	do.	do.	1981	X	H
361	414257-764246	Ayres, L.	Joseph W. Cummings and Son	1981	X	H
364	414246-764324	Butcher, D.	do.	1980	X	S
365	414306-764002	Whyte, J.	do.	1981	X	H
366	414305-764213	Greenough, R.	do.	1981	X	H
367	414307-764226	Andrus, D.	do.	1981	X	H
368	414249-764224	Johnston, L.	do.	1981	X	H
369	414051-764116	Pepper, T.	do.	1981	X	H
370	414207-764148	Kelley, J.	Donald K. Havens	1979	O	S
371	414247-764224	Butcher, D.	Joseph W. Cummings and Son	1977	X	H
372	414727-762651	Towanda Municipal Authority	Layne-New York Co., Inc.	1974	S	P
373	414731-762654	do.	do.	1974	S	P
374	415044-762954	Ulster Borough	—	1966	S	P
375	415044-762954	do.	W. H. Vanderhoof Drilling Co.	1979	S	P
376	414253-761951	Brown, D.	Joseph W. Cummings and Son	1980	X	H
377	414257-761946	Brown, R.	do.	1978	X	H
378	414256-762006	Hutchinson, H.	do.	1979	X	H
380	414206-760805	Stanton, V.	Stanley Thomas	1976	X	H
386	413904-761227	Snyder, R.	Robert F. Sanders	1979	X	H
387	414337-761413	Wolf, E.	Bell Brothers Drilling	1981	O	H
388	414346-761359	Waluk, T.	Joseph W. Cummings and Son	1978	O	H
389	414408-761348	Cook, C.	Bell Brothers Drilling	1979	—	P
390	414349-761407	Carter, D.	do.	1978	O	H
391	414354-761416	Quick, P.	Anthony P. Tomsic	1980	X	H
392	414400-761409	Edsell, W.	Joseph W. Cummings and Son	1981	X	H
393	414353-761406	Morse, M.	do.	1981	O	H
394	414356-761409	Millard, R.	Robert F. Sanders	1979	O	H
395	413656-762644	McGroarty, M.	do.	1979	X	P
398	413741-762502	Finnerty, G.	Anthony P. Tomsic	1977	X	H
413	415736-762954	Callear, R.	W. H. Vanderhoof Drilling Co.	1976	O	H
414	415737-762955	Webster, P.	do.	1978	O	H
415	415745-762947	Keir, R.	do.	1978	X	H
423	415844-762655	Conrad, J.	do.	1981	X	H
426	415802-761701	Wheaton, W.	do.	1980	X	S
427	415819-761735	Maffei, L.	do.	1980	O	H
429	415848-762014	Austin, F.	do.	1978	X	H
430	415757-761937	Windham Ambulance	do.	1979	X	P
431	415732-761854	Schrader, R.	James C. Vanderhoof	1979	X	H
434	415516-762155	Arnold, R.	do.	1977	X	H
435	415612-762110	Fisher, P.	W. H. Vanderhoof Drilling Co.	1980	X	H
436	415453-761900	Brown, R.	Joseph W. Cummings and Son	1977	X	H
437	415454-761903	Edsell, B.	W. H. Vanderhoof Drilling Co.	1979	X	H
442	415412-761810	Brink, F.	do.	1978	X	H
443	415419-761812	Scaturo, J.	do.	1979	O	H
447	415617-761813	Manwell, D.	Joseph W. Talcott	1980	X	H
450	415612-762623	Lantz, R.	W. H. Vanderhoof Drilling Co.	1979	O	H



Table 21.

Well location			Driller	Year completed	Type of completion	Use
Number	Lat-Long	Owner				
Br-455	414511-762448	Masonite Corp.	Layne-New York Co., Inc.	1977	S	N
456	414507-762454	do.	do.	1965	S	N
457	414527-762417	do.	do.	—	S	N
458	414707-762646	GTE Sylvania 1	—	1952	S	N
459	414707-762646	GTE Sylvania 2	—	1952	S	N
460	414711-762642	GTE Sylvania 3	—	1957	S	N
461	414707-762643	GTE Sylvania 4	—	1960	S	N
462	414718-762643	GTE Sylvania 5	Clarence W. Crandall	1964	S	N
463	414715-762648	GTE Sylvania 6	—	1967	S	N
464	414710-762643	GTE Sylvania 7	—	1969	S	N
465	414703-762639	GTE Sylvania 8	Germania Well Drilling Co.	1973	S	N
466	414706-762639	GTE Sylvania 9	—	1973	S	N
467	414705-762642	GTE Sylvania 10	Germania Well Drilling Co.	1975	S	N
468	414716-762647	GTE Sylvania 11	—	1978	S	N
476	415834-762457	Dawejko, E.	W. H. Vanderhoof Drilling Co.	1978	O	H
478	415726-762308	Wortman, E.	James C. Vanderhoof	1981	X	H
479	415532-762259	Arnold, J.	W. H. Vanderhoof Drilling Co.	1980	X	H
482	415426-762258	Dillabaugh, O.	do.	1979	X	H
494	415122-762108	Anderson, L.	do.	1978	X	H
496	415116-762036	Rafferty, W.	do.	1981	O	H
497	414925-762128	Bull, M.	Joseph W. Cummings and Son	1977	O	H
498	414946-762025	Hubbard Builders	W. H. Vanderhoof Drilling Co.	1978	O	H
499	414947-762019	do.	do.	1978	O	H
500	415004-761943	Chappell, L.	Joseph W. Cummings and Son	1978	X	H
501	415047-761701	Hansen, J.	W. H. Vanderhoof Drilling Co.	1979	X	H
502	415000-761714	Eastabrook, D.	Joseph W. Cummings and Son	1982	X	H
504	415051-761654	Perkins, J.	W. H. Vanderhoof Drilling Co.	1979	X	H
505	415056-761537	Carr, V.	Anthony P. Tomsic	1977	X	H
513	414044-761615	Oakley, B.	Strumski Well Drilling	1978	X	H
519	414045-761517	Taylor, K.	Jimcon Drilling	1980	X	H
520	414025-761619	Bonhammer, L.	Stanley Thomas	1979	X	H
521	414150-761828	Teraskavag, M.	Joseph W. Cummings and Son	1977	O	H
522	414043-761501	Snyder, B.	do.	1977	O	H
523	414151-761806	Smith, W.	do.	1980	X	S
524	414347-762027	Kuchinsky, G.	W. H. Vanderhoof Drilling Co.	1981	X	H
526	413804-761809	Napoli, P.	Bell Brothers Drilling	1981	X	H
528	413615-762704	Harding, D.	Donald E. Falsey	1981	X	H
529	413529-762528	Finan, R.	Joseph W. Cummings and Son	1982	X	H
530	413535-762621	Miller, G.	Robert F. Sanders	1981	X	H
531	413529-762617	Collins, J.	do.	1979	O	H
532	413525-762555	Spencer, J.	do.	1980	X	H
534	413558-762811	Hatch, R.	Donald E. Falsey	1981	X	S
535	413714-762439	Evergreen Church	Joseph W. Cummings and Son	1977	X	H
536	413641-762639	Lee, W.	Anthony P. Tomsic	1978	X	H
537	413530-762523	Finan, R.	Robert F. Sanders	1980	X	H
540	414707-762731	Dupont and Co.	Joseph W. Cummings and Son	1974	O	N
541	414709-762721	do.	do.	1974	S	N
542	414711-762714	do.	Atlantic Well Drilling Co.	1980	S	O
543	414713-762726	do.	do.	1980	S	O
544	414707-762711	do.	do.	1980	S	O
545	414703-762715	do.	do.	1981	S	O
546	414702-762724	do.	do.	1981	S	O
547	414705-762720	do.	do.	1981	S	O
548	414705-762724	do.	do.	1981	S	O
551	414713-762736	do.	W. H. Vanderhoof Drilling Co.	1958	X	N



Table 21.

Well location				Driller	Year completed	Type of completion	Use
Number	Lat-Long	Owner					
Br-552	414713-762715	United Methodist Church	Joseph W. Cummings and Son	1967	O	H	
553	414739-762724	Minard, R.	George E. Lamphere	1974	O	H	
554	414625-762355	Wysox Sand and Gravel	do.	1974	O	C	
555	414522-762520	State Aggregates	—	1983	—	N	
556	414546-762604	Fireplace II	Joseph W. Cummings and Son	1983	S	C	
557	414544-762604	do.	do.	1983	X	C	
558	414524-762449	Wilson, M.	do.	1980	S	O	
559	414519-762449	do.	do.	1980	S	O	
560	414518-762448	do.	do.	1980	S	O	
561	414518-762448	do.	do.	1980	S	O	
562	414517-762449	do.	do.	1980	S	O	
563	414517-762446	do.	do.	1980	S	O	
564	414516-762449	do.	do.	1980	S	O	
565	414517-762447	do.	do.	1980	S	O	
566	414516-762447	do.	do.	1980	S	O	
567	414516-762447	do.	do.	1980	S	O	
568	414517-762444	Cook, P.	do.	1980	S	O	
569	414510-762444	Wilson, M.	do.	1980	S	O	
570	414510-762444	do.	do.	1980	S	O	
601	415556-764310	Leonard, M.	W. H. Vanderhoof Drilling Co.	1981	O	H	
603	415553-764308	Cowles, E.	do.	1968	O	H	
604	414623-762413	Allen, L.	Joseph W. Cummings and Son	1979	O	H	
605	415628-764308	Walmsley, G.	W. H. Vanderhoof Drilling Co.	1982	O	H	
606	414920-762132	Weaver, B.	Joseph W. Cummings and Son	1978	O	H	
607	415632-764303	Chamberlain, D.	James C. Vanderhoof	1969	O	H	
608	414621-762425	Williams, H.	Joseph W. Cummings and Son	1966	O	H	
609	415523-764323	Fletcher, R.	W. H. Vanderhoof Drilling Co.	1980	O	H	
610	414616-762448	Brown, W.	do.	1966	O	P	
611	415945-763750	Carman, R.	do.	1981	O	H	
612	414616-762448	Brown, W.	Joseph W. Cummings and Son	1977	O	P	
613	415607-764113	Galvin, R.	W. H. Vanderhoof Drilling Co.	1977	O	H	
614	414618-762444	Taylor, L.	Joseph W. Cummings and Son	1981	O	H	
615	415544-764130	Galvin, R.	W. H. Vanderhoof Drilling Co.	1974	O	H	
616	414647-762339	Schmieg, J.	Joseph W. Cummings and Son	1977	O	H	
617	415504-764031	Doolittle, E.	James C. Vanderhoof	1980	O	H	
618	414640-762244	Blanchard, T.	George E. Lamphere	1974	O	H	
619	415302-764204	Dunbar, D.	W. H. Vanderhoof Drilling Co.	1980	O	H	
620	414622-762356	Sims, H.	Joseph W. Cummings and Son	1983	O	H	
621	415819-764226	Innman, L.	W. H. Vanderhoof Drilling Co.	1974	O	H	
622	414740-762450	Wygrala, J.	Joseph W. Cummings and Son	1981	X	H	
623	415922-764335	Sullivan, D.	James C. Vanderhoof	1975	O	H	
624	414800-762456	Girven, D.	Joseph W. Cummings and Son	1979	O	H	
625	415819-764253	Tice, H.	W. H. Vanderhoof Drilling Co.	1981	O	H	
626	414551-762602	Fleming, W.	Joseph W. Cummings and Son	1975	O	H	
627	415623-764243	North Penn Telephone Co.	W. H. Vanderhoof Drilling Co.	1974	O	C	
628	414528-762549	Evans, R.	do.	1966	O	H	
629	415211-763807	Schrimp, S.	do.	1981	O	H	
630	414521-762523	Hollenback, B.	Joseph W. Cummings and Son	1983	X	S	
631	415652-764246	Wilbur, G.	W. H. Vanderhoof Drilling Co.	1969	O	H	
632	414624-762405	Benjamin, H.	Joseph W. Cummings and Son	1979	O	H	
633	415731-764302	Rimbey, R.	W. H. Vanderhoof Drilling Co.	1971	O	H	
634	414614-762454	Ward, J.	Joseph W. Cummings and Son	1968	O	C	
635	415918-764333	Hanigan, R.	W. H. Vanderhoof Drilling Co.	1968	O	H	
636	414626-762407	Mulcahy, P.	Joseph W. Cummings and Son	1978	O	H	
637	415817-764317	Daugherty, C.	James C. Vanderhoof	1967	O	H	



Table 21.

Well location				Driller	Year completed	Type of completion	Use
Number	Lat-Long	Owner					
Br-638	41°46'12"-762307	Benjamin, M.		Joseph W. Cummings and Son	1981	O	H
639	41°58'20"-764306	Strait, L.		W. H. Vanderhoof Drilling Co.	1973	X	H
640	41°55'55"-762556	Dickerson		do.	1967	O	H
641	41°58'17"-764223	Lewis, C.		do.	1975	X	H
642	41°55'55"-762602	Williams, T.		Joseph W. Cummings and Son	1966	O	H
643	41°59'01"-764324	Mobile Acres Park		Clarence W. Crandall	1981	O	P
644	41°55'49"-762550	Walker, L.		Joseph W. Cummings and Son	1982	O	H
645	41°59'01"-764324	Mobile Acres Park		Clarence W. Crandall	1981	O	P
646	41°50'19"-763021	Cotter, T.		W. H. Vanderhoof Drilling Co.	1967	O	H
647	41°56'27"-764238	Allen, P.		do.	1976	O	H
648	41°49'41"-763041	Perenchinsky, J.		James C. Vanderhoof	1968	O	H
649	41°56'49"-764215	Wood, J.		do.	1973	X	H
650	41°49'29"-763039	Jackson, A.		do.	1975	O	H
651	41°56'44"-764228	Carlson, M.		W. H. Vanderhoof Drilling Co.	1971	O	H
652	41°49'25"-763036	Morningstar, C.		do.	1969	O	H
653	41°50'04"-764811	Brackman, L.		do.	1967	X	H
654	41°50'30"-763016	Stowell, E.		do.	1969	O	H
655	41°51'36"-764632	Schaeffer, R.		do.	1981	O	H
656	41°50'30"-763016	Stowell, E.		do.	1973	O	H
657	41°50'35"-764813	Whitteker, R.		Donald K. Havens	1983	O	H
658	41°46'36"-763342	Weed, S.		Joseph W. Cummings and Son	1981	O	H
659	41°50'40"-764759	Vanderpool, E.		do.	1984	O	H
660	41°46'52"-763359	Wolstenholme, R.		W. H. Vanderhoof Drilling Co.	1976	O	H
663	41°51'15"-764839	Albertson, E.		Donald K. Havens	1975	O	P
664	41°47'20"-763223	Smith, R.		Joseph W. Cummings and Son	1979	O	H
666	41°59'47"-762808	Daddona, P.		W. H. Vanderhoof Drilling Co.	1978	O	H
667	41°55'23"-764729	Chambers, J.		do.	1966	O	H
668	41°59'40"-762820	Button, R.		do.	1972	O	H
669	41°56'50"-764251	Wilcox		do.	1969	O	H
670	41°59'40"-762817	McQueeney, J.		do.	1971	O	H
671	41°57'24"-764544	White, J.		James C. Vanderhoof	1973	O	H
672	41°59'37"-762826	Terpko, J.		W. H. Vanderhoof Drilling Co.	1980	X	H
673	41°56'41"-764250	Besanceney, W.		do.	1967	O	H
674	41°59'43"-762838	Haggerty, J.		do.	1971	O	H
675	41°46'36"-764829	Mack, N.		Donald K. Havens	1978	O	H
676	41°59'49"-762834	Docktor, A.		W. H. Vanderhoof Drilling Co.	1967	O	H
677	41°57'16"-764747	Craig, G.		James C. Vanderhoof	1969	O	H
678	41°58'42"-763315	Forrest, A.		W. H. Vanderhoof Drilling Co.	1981	X	H
679	41°57'05"-764740	Oldroyd, C.		Donald K. Havens	1981	O	H
680	41°59'03"-763449	Velardo, M.		W. H. Vanderhoof Drilling Co.	1980	X	H
681	41°56'49"-764745	Vandermark, B.		do.	1967	O	H
682	41°59'50"-763417	Pekunas, J.		do.	1975	O	H
683	41°59'00"-764624	Yeomans, A.		James C. Vanderhoof	1970	O	H
684	41°59'30"-763348	Hoover, K.		W. H. Vanderhoof Drilling Co.	1982	O	H
686	41°59'30"-763348	do.		do.	1981	O	H
687	41°56'59"-764753	Kennedy, J.		James C. Vanderhoof	1966	O	H
688	41°59'54"-763422	Pareek		W. H. Vanderhoof Drilling Co.	1980	O	H
689	41°56'40"-764742	Morgan, M.		James C. Vanderhoof	1969	O	H
690	41°59'55"-763429	Coveleskie		W. H. Vanderhoof Drilling Co.	1978	O	H
691	41°56'27"-764748	Goncarovs, O.		do.	1982	O	H
692	41°59'55"-763431	Lagrando, D.		do.	1977	X	H
693	41°57'32"-765203	Metzger, L.		Willard S. Kuser	1981	O	H
694	41°59'55"-763435	Gilbert, C.		W. H. Vanderhoof Drilling Co.	1977	O	H
695	41°50'22"-763907	Ward, R.		do.	1968	O	H
696	41°59'55"-763438	Hill, R.		do.	1976	O	H



Table 21.

Well location		Owner	Driller	Year completed	Type of completion	Use
Number	Lat-Long					
Br-497	414206-763034	Davis, G.	Joseph W. Cummings and Son	1983	O	H
698	415955-763442	Mann, M.	W. H. Vanderhoof Drilling Co.	1976	O	H
699	414154-764943	Denkenberger, R.	Willard S. Kuser	1970	O	H
700	415955-763446	Amlot, M.	W. H. Vanderhoof Drilling Co.	1976	X	H
701	414215-765001	Ribovich, J.	Willard S. Kuser	1975	O	H
702	415955-763451	Chacona	W. H. Vanderhoof Drilling Co.	1976	X	H
703	414519-763927	Welch, A.	Joseph W. Cummings and Son	1966	O	H
704	415955-763455	Wolfe	W. H. Vanderhoof Drilling Co.	1978	X	H
705	415211-763809	Kingsley, M.	do.	1974	O	H
706	415956-763504	Kinch, G.	do.	1975	X	H
707	415158-764012	Harkness, L.	do.	1980	O	S
708	415954-763508	Stewart	do.	1978	X	H
709	414947-764149	Bozzuffi, J.	do.	1981	O	H
710	415952-763501	Clark, F.	do.	1975	X	H
711	414916-764438	Weed, K.	do.	1978	O	H
712	415951-763451	Lantz, J.	do.	1977	X	H
713	414709-763652	Wolfe, N.	Joseph W. Cummings and Son	1982	O	C
714	415952-763438	Hubbard Builders	W. H. Vanderhoof Drilling Co.	1979	X	H
715	414707-763652	Wolfe, H.	do.	1976	O	H
716	415952-763435	Rudolph	do.	1978	O	H
717	414628-762926	Benjamin, R.	Joseph W. Cummings and Son	1983	O	H
718	415952-763432	Ramans, G.	W. H. Vanderhoof Drilling Co.	1979	X	H
720	415952-763429	Daga, R.	do.	1979	X	H
721	413552-765229	Rathbun, R.	Willard S. Kuser	1984	O	H
722	415952-763426	McPherson	W. H. Vanderhoof Drilling Co.	1979	O	H
723	413657-765136	St. John's United Methodist Church	Donald K. Havens	1981	O	P
724	415846-763309	Miller	W. H. Vanderhoof Drilling Co.	1967	O	H
725	413844-765205	Parker, R.	Willard S. Kuser	1983	O	H
726	415955-762756	Palmer, G.	W. H. Vanderhoof Drilling Co.	1973	O	H
727	414216-764940	Parks, G.	Willard S. Kuser	1983	O	H
728	415507-763302	Maxwell, A.	W. H. Vanderhoof Drilling Co.	1981	O	H
730	415542-763207	Cariing, R.	do.	1980	O	H
732	415741-763007	Merrill, H.	do.	1980	O	H
734	415737-763022	Mitchell, S.	do.	1981	O	H
736	415736-763022	Hartjen, M.	do.	1969	O	H
738	415738-763035	Horton, R.	do.	1976	O	H
740	415738-763035	do.	do.	1981	O	H
742	415712-763011	Vonwolfradt, F.	do.	1971	O	H
744	415722-763017	Merritt	do.	1974	O	H
746	415736-763006	Vanfleet, W.	do.	1969	O	H
747	414736-762721	Chamberlain, R.	do.	1977	X	H
748	415743-762949	Cron, R.	do.	1967	O	H
749	415045-762956	Ulster Borough	Clarence W. Crandall	1965	O	T
750	415815-763033	Kinner, S.	W. H. Vanderhoof Drilling Co.	1968	O	H
751	415047-763000	Ulster Borough	Clarence W. Crandall	1965	O	T
752	415418-763334	Thurston, R.	Loune M. Fritz	1978	O	H
753	415634-764255	Adams, D.	James C. Vanderhoof	1979	O	H
754	415423-763207	Lantz, E.	W. H. Vanderhoof Drilling Co.	1969	O	H
755	415604-764302	Miller, J.	do.	1981	O	H
756	415421-763152	Miller, C.	do.	1975	O	H
757	415559-764304	Henry, H.	do.	1970	O	H
758	415421-763149	Smith, R.	James C. Vanderhoof	1980	O	H
759	415819-764238	Paul, G.	Joseph W. Cummings and Son	1981	O	H
760	415424-763137	Walker, D.	W. H. Vanderhoof Drilling Co.	1968	O	H



Table 21.

Well location			Driller	Year completed	Type of completion	Use
Number	Lat-Long	Owner				
Br-761	415609-763046	Johnson, J.	W. H. Vanderhoof Drilling Co.	1974	O	I
762	415608-763044	do.	—	1983	P	O
763	415934-763250	Whipple Brothers., Inc.	W. H. Vanderhoof Drilling Co.	1978	O	H
764	415816-763203	Drake, J.	do.	—	O	H
765	415829-763212	Stark	—	1984	—	H
766	415957-763202	Evans, R.	W. H. Vanderhoof Drilling Co.	1981	X	H
767	415926-763134	Smith, F.	do.	1966	O	H
768	415854-763118	Packer Hospital	—	1983	S	T
769	415844-763112	Sayre Motel	W. H. Vanderhoof Drilling Co.	1968	O	C
771	415810-763215	Utter, C.	do.	1968	O	C
772	415819-763154	Northrup, R.	do.	1981	O	H
773	415810-763211	Bailey, R.	do.	1981	O	H
775	415939-763253	Rosh, N.	do.	1969	O	H
776	415927-763134	Smith, W.	do.	1969	O	H
777	415925-763031	Decker, L.	do.	1978	O	H
778	415926-763012	Millard, R.	do.	1968	O	H
779	415938-762924	Campbell, E.	do.	1966	O	H
780	415905-763034	Sayre Borough	—	—	—	P
781	415647-763001	Brennan	—	—	X	H
783	415807-763039	Sayre Water Co.	—	1974	S	T
784	415845-763040	do.	—	1974	O	T
785	415747-763053	do.	—	1974	O	T
786	415802-763039	do.	—	1974	S	T
787	415746-763040	do.	—	1974	S	T
788	415747-763048	do.	—	1974	S	T
789	415740-763041	do.	—	1974	S	T
790	415732-763040	do.	—	1974	S	T
791	415727-763040	do.	—	1974	S	T
793	415726-763049	do.	—	1974	S	T
794	415802-763045	do.	—	1974	—	T
795	415802-763042	do.	—	1974	—	T
796	415802-763040	do.	—	1974	S	T
797	415807-763043	do.	—	1974	S	T
798	415955-763230	Konkler, F.	—	—	O	H
799	415050-763002	Ulster Borough	Clarence W. Crandall	1965	—	T
800	415634-763045	Sayre Water Co.	—	1972	O	O
801	415644-763023	U.S. Geological Survey	Eichelberger Well Drilling	1984	O	O
802	414651-763627	Burlington Church	Donald K. Havens	1985	O	H
803	414937-764142	Wetona Church	do.	1985	O	H
804	415022-765220	Garrison, R.	do.	1984	O	H
805	413842-765201	Tillotson, C.	do.	1985	O	P
806	415440-761859	North Orwell Church	Joseph W. Cummings and Son	1982	O	H
807	415149-761412	Northeast Bradford High School	W. H. Vanderhoof Drilling Co.	1969	O	P
808	413934-761529	Wells Mills Water Co.	Donald K. Havens	1985	O	P
809	413938-761527	do.	do.	1985	O	P
810	413933-761537	do.	do.	1985	O	P
811	415301-762957	Dubuque, K.	James C. Vanderhoof	1978	O	H
812	415057-762921	Gillette, W.	do.	1971	X	H
813	415938-763116	Pennsylvania Department of Transportation	Pennsylvania Department of Transportation	1982	X	T
814	415938-763114	do.	do.	1982	X	T
815	415938-763111	do.	do.	1982	X	T
816	415938-763109	do.	do.	1982	X	T
818	415145-761414	Northeast Bradford High School	W. H. Vanderhoof Drilling Co.	1969	X	P

(Continued)

Altitude of land surface (feet)	Aquifer	Depth of well (feet)	Water level								
			Casing		Depth below land surface (feet)	Date measured (mo/yr)	Reported yield (gal/min)	Specific conductance (μmho/cm)	Hardness, as CaCO <sub>3</sub> (mg/L)	Well number	
			Depth (feet)	Diameter (inches)							
750	Qsd/u	77	77	12	20	2/74	500	—	—	Br-761	
750	Qsd/u	35	35	2	14	6/84	—	—	—	762	
830	Dlh	100	100	6	23	6/84	5	—	—	763	
770	Qsd/c	100	100	6	18	6/84	—	260	220	764	
790	—	—	—	—	28	6/84	—	280	205	765	
850	Dlh	79	47	6	30	6/84	10	300	155	766	
810	Qsd/c	65	65	6	24	6/84	14	390	310	767	
780	Qsd/c	112	102	6	17	6/84	22	1,500	600	768	
780	Qsd/u	28	28	6	20	6/84	50	—	—	769	
770	Qsd/c	105	105	6	20	9/68	12	—	—	771	
780	Qsd/u	27	27	6	18	7/81	20	—	—	772	
770	Qsd/c	87	87	6	25	12/81	15	—	—	773	
800	Dlh	127	94	6	25	9/69	12	—	—	775	
810	Qsd/c	77	77	6	35	4/69	25	—	—	776	
780	Qsd/c	132	132	6	30	10/78	40	—	—	777	
800	Qsd/c	76	76	6	—	—	15	—	—	778	
790	Qsd/c	168	168	6	24	6/84	25	—	—	779	
760	Qsd/u	12	—	—	4	6/84	—	—	—	780	
770	Dlh	147	107	6	—	—	—	—	—	781	
770	Qsd/u	46	46	2.5	16	5/74	60	—	—	783	
760	Qt	103	103	—	—	—	—	—	—	784	
755	Qsd/c	162	162	2.5	8	3/74	—	—	—	785	
770	Qsd/u	35	30	2.5	9	4/74	45	—	—	786	
760	Qsd/u	27	22	2.5	5	4/74	45	—	—	787	
760	Qsd/u	35	30	2.5	8	4/74	35	—	—	788	
760	Qsd/u	31	26	2.5	7	4/74	35	—	—	789	
755	Qsd/u	35	30	2.5	9	4/74	40	—	—	790	
755	Qsd/u	31	26	2.5	13	4/74	35	—	—	791	
750	Qsd/u	32	27	2.5	10	4/74	30	—	—	793	
760	Qsd/u	—	—	—	16	4/74	—	—	—	794	
765	Qsd/u	—	—	—	16	4/74	—	—	—	795	
770	Qsd/u	70	65	2.5	15	5/74	65	—	—	796	
760	Qsd/u	35	30	2.5	15	5/74	35	—	—	797	
820	Qsd/u	32	32	6	23	11/84	—	—	—	798	
840	Dlh	—	—	—	—	—	—	—	—	799	
760	Qsd/u	49	49	6	19	1/72	7	—	—	800	
750	Qt	144	144	6	13	9/84	6	—	185	801	
880	Qsd/u	58	58	6	10	4/85	6	360	—	802	
1,240	Qt	61	61	6	—	—	20	—	—	803	
1,270	Qsd/c	72	72	6	—	—	20	—	—	804	
1,260	Qsd/u	25	25	6	—	—	30	—	—	805	
1,020	Qsd/u	44	44	6	7	7/84	10	—	—	806	
1,160	Qsd/u	52	52	8	7	7/84	75	140	70	807	
690	Qsd/c	125	125	6	46	10/85	75	220	100	808	
690	Qsd/u	81	81	6	47	10/85	26	465	—	809	
660	Qsd/c	97	97	6	19	10/85	30	340	—	810	
770	Qsd/u	78	78	6	—	—	6	510	—	811	
780	Dlh	98	76	6	—	—	8	—	—	812	
790	Dlh	—	—	—	—	—	—	—	—	813	
780	Dlh	—	—	—	23	3/82	—	—	—	814	
780	Dlh	—	—	—	9	2/82	—	—	—	815	
790	Dlh	—	—	—	14	2/82	—	—	—	816	
1,160	Dlh	160	78	8	17	7/84	70	—	—	818	

Table 21.

Well location				Driller	Year completed	Type of completion	Use
Number	Lat-Long	Owner					
Br-819	415655-763104	Pennsylvania Department of Transportation	Pennsylvania Department of Transportation		1985	X	T
820	415733-763145	do.	do.		1975	X	T
821	415734-763144	do.	do.		1975	X	T
822	415735-763144	do.	do.		1975	X	T
823	415908-763320	do.	do.		1975	X	T
824	415912-763317	do.	do.		1975	X	T
825	415915-763311	do.	do.		1975	X	T
826	415143-761412	Northeast Bradford High School	W. H. Vanderhoof Drilling Co.		1966	X	P
827	414743-762752	Wright	—	—	—	O	H
828	414743-762804	—	Donald K. Havens		1986	O	H
829	414625-763724	Bradford County Home	—	—	—	S	P
830	414735-762726	Kenney	—	—	—	O	H
831	414105-761457	Taylor Packing Co.	James R. Cavanaugh		1983	X	N
832	414107-761456	do.	—	—	1975	X	N
833	414057-761503	do.	—	—	—	—	N
834	414111-761452	do.	James R. Cavanaugh		1983	P	Z
835	414109-761451	do.	do.		1983	P	O
836	414111-761453	do.	C. J. Martin and Sons		1983	P	O
837	414109-761452	do.	do.		1983	P	O
838	414109-761451	do.	do.		1983	P	O
839	414113-761454	do.	do.		1983	P	O
840	414113-761453	do.	do.		1983	P	O
841	414114-761453	do.	do.		1983	P	O
842	414117-761455	do.	do.		1986	X	O
843	415020-762952	U.S. Geological Survey	U.S. Geological Survey		1986	—	T
844	415402-763058	do.	do.		1986	S	O
845	415406-763059	do.	do.		1986	S	O
POTTER							
Po- 5	415532-780713	Dairymen's Coop. Assoc.	Claude Cook	—	—	O	N
39	415404-774554	Lewisville Water Co.	—	—	—	X	P
40	415414-774554	Galeton Dairy	John J. Cizek	—	—	X	N
65	415624-773851	Harrison Valley Water Co.	—	1900	—	X	B
76	414339-773929	Galeton-Eldred Water Co.	Layne-New York Co., Inc.	1960	—	X	P
127	414752-774310	Slaby, J.	Germania Well Drilling Co.	1979	—	X	H
128	415050-774212	Hollis, D.	Walter L. Phillips	1978	—	X	H
129	415146-774259	Stephens, J.	do.	1979	—	X	H
132	414704-774416	Dunroven Sport Club	Germania Well Drilling Co.	1979	—	X	H
133	414650-774448	Reeser, A.	do.	1979	—	X	H
135	414721-774445	Brown, C.	do.	1979	—	X	H
136	414950-774231	Tubbs, W.	do.	1978	—	X	H
137	414751-774304	Stahley, G.	do.	1979	—	X	H
138	414646-774408	Duell, H.	do.	1975	—	X	H
140	415205-774627	Klutchkowi, K.	do.	1978	—	X	H
141	415010-774741	Biele, R.	do.	1977	—	X	H
143	414813-774637	Wintersteen, J.	do.	1978	—	X	H
144	414812-774630	Morow, H.	do.	1979	—	X	H
145	414721-774516	Jackson, W.	do.	1979	—	X	H
146	414721-774501	Tribotte, J.	do.	1976	—	X	H
147	414725-774513	Frey, J.	do.	1979	—	X	H
148	414726-774510	Cook, S.	do.	1978	—	X	H
149	414720-774447	Schappell, R.	do.	1980	—	X	H
150	414645-774451	Bosserman, M.	do.	1978	—	X	H

(Continued)

Altitude of land surface (feet)	Aquifer	Depth of well (feet)	Water level								
			Casing		Depth below land surface (feet)	Date measured (mo/yr)	Reported yield (gal/min)	Specific conductance (μmho/cm)	Hardness, as CaCO <sub>3</sub> (mg/L)	Well number	
			Depth (feet)	Diameter (inches)							
730	Ql	—	—	—	—	—	—	—	—	Br-819	
740	Qt	—	—	—	—	—	—	—	—	820	
740	Qt	—	—	—	—	—	—	—	—	821	
740	Qt	—	—	—	—	—	—	—	—	822	
760	Qt	—	—	—	—	—	—	—	—	823	
760	Qt	—	—	—	—	—	—	—	—	824	
770	Qt	—	—	—	13	—/75	—	—	—	825	
1,160	Qsd/u	44	44	8	4	7/84	40	—	—	826	
770	Qsd/u	72	72	6	61	8/83	—	—	—	827	
800	Qsd/u	120	120	6	—	—	—	—	—	828	
880	Qsd/u	52	46	8	7	1/75	—	—	—	829	
770	Qsd/u	89	89	6	64	8/83	—	—	—	830	
750	Dck	336	87	8	—	—	110	—	—	831	
750	Dck	300	100	8	—	—	—	—	—	832	
710	Dck	135	—	6	20	9/80	41	—	—	833	
760	Qsd/u	80	40	6	35	11/83	—	—	—	834	
740	Qsd/u	60	20	6	38	11/83	—	—	—	835	
760	Qsd/u	60	20	6	33	11/83	—	—	—	836	
750	Qsd/u	40	20	6	19	11/83	—	—	—	837	
750	Qsd/u	60	20	6	30	11/83	—	—	—	838	
750	Qsd/u	36	20	6	—	—	—	—	—	839	
760	Qsd/u	60	20	6	35	12/83	—	—	—	840	
760	Qsd/u	60	20	6	—	—	—	—	—	841	
800	Qsd/u	80	30	6	—	—	—	—	—	842	
730	Qt	—	—	—	—	—	—	—	—	843	
740	Qsd/u	32	27	2	—	—	—	—	—	844	
740	Qsd/u	25	20	2	—	—	—	—	—	845	
<b>COUNTY</b>											
1,550	Qsd/u	36	36	6	4	8/35	12	—	45	Po-	5
2,100	Dck	126	22	6	4	8/35	40	168	55	—	39
2,070	Dck	92	33	6	—	—	.25	—	—	—	40
1,620	Dlh	200	50	—	-25	—/35	110	—	—	—	65
1,350	Dck	218	66	12	—	—	200	—	—	—	76
1,680	Dlh	155	52	6	55	—	20	—	—	—	127
1,720	Dck	65	37	6	30	9/78	8	—	—	—	128
1,880	MDhm	64	61	6	40	7/79	15	—	—	—	129
1,540	Dlh	106	39	6	6	6/79	5	—	—	—	132
1,570	Dck	60	30	6	5	1/79	10	—	—	—	133
1,570	Dlh	84	61	6	27	7/81	12	260	120	—	135
1,700	Dck	122	92	6	41	7/81	12	180	85	—	136
1,580	Dlh	95	71	6	33	7/81	40	350	50	—	137
1,500	Dck	65	25	6	3	7/81	30	300	120	—	138
2,340	MDhm	140	39	6	65	12/78	40	—	—	—	140
1,880	Dck	155	40	6	50	7/77	40	140	50	—	141
1,700	Dck	161	48	6	20	8/78	20	—	—	—	143
1,640	Dck	43	30	6	28	3/79	80	—	—	—	144
1,620	Dlh	60	40	6	30	12/79	15	—	—	—	145
1,580	Dck	92	44	6	—	—	10	—	—	—	146
1,600	Dck	100	62	6	20	3/79	20	—	—	—	147
1,620	Dck	114	43	6	—	—	5	230	85	—	148
1,620	Dck	125	36	6	80	9/80	8	—	—	—	149
1,580	Dck	54	32	6	15	5/78	40	—	—	—	150

Table 21.

Well location				Driller	Year completed	Type of completion	Use
Number	Lat-Long	Owner					
Po-166	414435-773628	Gundrum, G.		Germania Well Drilling Co.	1980	X	H
167	414434-773628	Bell, E.		Coudersport Well Drilling	1980	X	H
168	414236-773636	Craig, T.		Germania Well Drilling Co.	1979	X	H
169	414348-773819	Kefover, M.		Coudersport Well Drilling	1979	X	H
170	414351-773819	Crain, S.		Germania Well Drilling Co.	1977	X	H
175	414404-773819	Thompson, R.		do.	1979	X	H
176	415635-773947	Northern Tier Children's Home		do.	1979	X	P
177	415620-773841	Truax, R.		do.	1979	X	H
178	415720-773858	Cady, A.		do.	1978	X	P
179	415527-774409	Vanetten, W.		do.	1979	X	H
180	415454-773638	Walters, L.		do.	1974	X	H
181	415835-773723	Pumstead		do.	1974	O	H
182	415511-773726	Cole, C.		do.	1977	X	H
183	415626-773849	Harrison Valley School		do.	1980	X	P
184	415634-773858	Stone, H.		do.	1979	X	H
185	415732-773852	Kibbie, L.		Walter L. Phillips	1978	O	H
186	415634-774201	Pollock, C.		Robert Mulvy	1973	X	H
188	415329-774220	Grover, J.		Germania Well Drilling Co.	1980	X	H
189	415326-774212	Lampman, S.		do.	1979	X	H
190	415820-774352	Kenderline, H.		do.	1971	O	H
201	414818-774630	Strausbaugh, E.		do.	1978	X	H
226	414625-774227	Bowen, P.		do.	1979	X	H
227	414623-774220	Lewis Motel		do.	1977	X	P
228	414418-773926	Green, W.		do.	1979	X	H
229	414339-773950	Kertsmar, R.		do.	1979	X	H
232	415924-780758	Olmstead, C.		Cecil Olmstead	1971	O	H
233	415927-780800	Dickerson, L.		do.	1974	O	H
234	415505-780114	Stearns, G.		Cleo Harris	1968	O	H
235	415741-780124	Daily, J.		do.	1982	X	H
236	415624-780845	Shield, J.		do.	1969	O	H
237	415525-780712	Glougeski		do.	1978	X	H
238	415527-780705	Carpenter, R.		do.	1967	O	H
239	415622-780845	Newton, W.		Walter L. Phillips	1975	O	H
240	415812-781219	Lewis, A.		Cecil Olmstead	1984	O	H
241	415411-780356	Hatter, R.		do.	1971	X	H
242	415504-780109	Amadon, L.		Cleo Harris	1981	O	H
243	415443-780144	Kjelgaard, H.		do.	1970	X	H
244	415623-780840	Morris, H.		Walter L. Phillips	1975	O	H
245	415833-780938	Creighton, J.		do.	—	O	H
246	415920-780750	Moorefoote, H.		Cecil Olmstead	1981	O	H
247	415817-775301	Galley, D.		Germania Well Drilling Co.	1979	X	H
248	415812-775104	Elliott, W.		Cecil Olmstead	1978	X	H
249	415643-774857	Skreba, L.		Germania Well Drilling Co.	1983	O	H
250	415745-775039	Jones, R.		Eichelberger Well Drilling	1983	X	H
251	415624-774847	Burdge, M.		Coudersport Well Drilling	1980	X	H
252	415625-774843	Ward, T.		do.	1982	X	H
254	415917-775216	Blichasz, E.		Germania Well Drilling Co.	1983	X	H
255	415520-774650	Clark, R.		do.	1984	X	H
256	415246-774901	Brooke, M.		do.	1978	X	H
257	414709-774428	Tribotte, J.		do.	1976	X	H
258	415431-780550	Watterson, R.		Cecil Olmstead	1985	O	H
259	414153-774435	Seeley, H.		Germania Well Drilling Co.	1971	X	H
260	413318-774214	Bell, M.		do.	1981	X	H
261	413322-774210	Naugle, J.		do.	1982	X	H

(Continued)

Altitude of land surface (feet)	Aquifer	Depth of well (feet)	Water level								Well number	
			Casing		Depth below land surface (feet)	Date measured (mo/yr)	Reported yield (gal/min)	Specific conductance (μmho/cm)	Hardness, as CaCO <sub>3</sub> (mg/L)			
			Depth (feet)	Diameter (inches)								
1,320	Dck	95	27	6	40	9/80	15	—	—	Po-166		
1,350	Dck	150	91	6	110	12/80	—	170	105	167		
1,750	Dck	151	42	6	80	7/81	12	590	275	168		
1,410	Dck	75	41	6	60	9/79	5	45	70	169		
1,420	Dck	170	46	6	75	11/77	7	—	—	170		
1,340	Dck	106	40	6	36	7/81	5	1,400	205	175		
1,710	Dlh	140	63	6	40	7/79	60	470	205	176		
1,620	Dlh	92	92	6	F	3/79	10	310	170	177		
1,750	Dlh	99	76	6	F	10/78	16	—	—	178		
2,200	Dck	210	19	6	110	11/79	6	—	—	179		
1,500	Dlh	95	80	6	21	7/81	10	610	50	180		
1,710	Qt	42	42	6	—	—	10	370	155	181		
1,520	Dlh	103	15	6	—	—	7	650	—	182		
1,630	Dlh	135	87	6	10	7/80	40	440	170	183		
1,660	Dlh	87	47	6	-3	1/79	60	460	170	184		
1,740	Qsd/u	40	40	6	F	7/81	—	380	190	185		
1,830	Dlh	84	34	6	40	9/73	10	370	220	186		
1,990	MDhm	141	39	6	60	9/80	10	—	—	188		
2,000	MDhm	85	51	6	40	10/79	40	180	50	189		
2,070	Qt	75	75	6	—	10/71	10	—	—	190		
1,630	Dck	55	26	6	40	8/78	40	—	—	201		
1,470	Dck	65	31	6	—	—	14	925	170	226		
1,460	Dck	87	27	6	F	12/79	36	—	—	227		
1,350	Dck	63	31	6	35	8/79	30	—	—	228		
1,420	Dck	150	71	6	80	11/79	20	—	—	229		
1,520	Qsd/u	45	45	—	20	7/71	—	230	70	232		
1,530	Qsd/u	38	38	6	—	—	—	230	70	233		
1,690	Qsd/u	59	59	6	15	10/68	15	140	50	234		
1,880	Dch	100	58	6	50	11/82	40	95	50	235		
1,520	Qsd/u	60	60	6	19	3/69	30	110	50	236		
1,550	Dch	230	205	6	30	6/78	30	525	35	237		
1,550	Qsd/u	28	28	6	5	11/67	40	110	35	238		
1,520	Qsd/u	33	32	6	15	8/75	—	170	70	239		
1,490	Qsd/u	48	48	6	23	10/84	40	225	70	240		
1,620	Dck	57	54	6	F	4/71	—	—	—	241		
1,700	Qsd/u	54	54	6	20	9/81	15	—	—	242		
1,670	Dck	70	45	6	25	11/70	23	—	—	243		
1,520	Qsd/u	41	41	6	14	7/75	—	—	—	244		
1,510	Qsd/u	71	71	6	40	—	30	—	—	245		
1,510	Qsd/u	45	45	6	22	10/81	50	—	—	246		
1,760	Dck	117	107	6	10	6/79	20	190	70	247		
1,770	Dck	114	50	6	44	11/78	8	270	85	248		
1,780	Qsd/u	101	101	6	5	7/83	4	340	70	249		
1,810	Dck	160	105	6	70	6/83	25	225	105	250		
1,800	Dlh	122	118	6	60	9/80	—	325	70	251		
1,820	Dck	130	125	6	40	8/82	—	—	—	252		
1,640	Dck	50	34	6	10	8/83	35	—	—	254		
1,950	Dck	138	120	6	F	4/84	—	—	—	255		
2,130	Dck	85	66	6	32	4/78	40	—	—	256		
1,530	Dlh	92	44	6	—	—	10	—	—	257		
1,600	Qsd/u	63	63	6	20	5/85	35	—	—	258		
1,520	Dck	62	34	8	8	7/85	40	175	70	259		
1,270	Dck	72	26	6	40	4/81	20	360	70	260		
1,330	Dck	123	38	6	70	7/82	30	230	60	261		

Table 21.

Well location			Driller	Year completed	Type of completion	Use
Number	Lat-Long	Owner				
Po-262	414635-774315	Flynn, C.	Germania Well Drilling Co.	1966	X	H
263	414720-774252	Duell, R.	do.	1981	X	H
264	414459-774029	Monroe, E.	do.	1978	X	H
265	414627-774233	Trench, A.	—	—	—	H
266	415633-773936	Northern Tier Children's Home	Germania Well Drilling Co.	1968	X	H
267	415630-773858	Melcalf, F.	McLaughlin Well Drilling Co.	1979	X	H
268	415042-774210	Millheim, L.	Germania Well Drilling Co.	1976	X	H
269	414901-774231	Gursky, W.	do.	1969	O	H
270	415612-773830	Munson, C.	McLaughlin Well Drilling Co.	1983	X	H
271	414628-774241	Krouse, H.	Germania Well Drilling Co.	1982	X	H
272	414612-774159	Untouchables Hunting Club	Eichelberger Well Drilling	1984	X	H
273	414537-774111	Crandle, J.	Germania Well Drilling Co.	1981	X	H
274	414615-774157	Towney	Coudersport Well Drilling	1982	X	H
275	415647-774117	Stoltzfus, A.	Germania Well Drilling Co.	1982	X	H
276	415641-774119	Mills Union Church	do.	—	X	H
278	414634-774301	West Pike Church	do.	1978	X	H
281	415405-774553	Lewisville Water Co.	G. W. Matthews	1961	X	P
282	415749-781153	Shinglehouse Borough Water Department	W. E. Lanphere	1972	S	P
283	415738-781148	do.	—	1941	S	P
284	415749-781153	do.	—	1922	X	P
285	415801-781108	do.	Howard Gale	1955	S	P
TIoga						
Ti- 1	414510-773333	Wilson, R.	—	—	W	H
3	415030-771627	Renken Dairy	York of New York	—	X	N
4	415030-771627	do.	William Rogers	1932	X	N
5	415917-771820	Elkland Borough	John J. Cizek	—	O	P
6	415931-771833	Elkland Leather	do.	—	O	N
7	415936-771839	Elkland Borough	do.	—	O	P
9	415921-771914	Borden Co. of Pennsylvania	—	—	X	N
10	415921-771914	do.	—	—	X	N
11	415854-772040	Crandal	John J. Cizek	—	O	H
12	415902-772033	Oscela Water Assoc.	—	—	X	N
15	415728-772639	Wood, C.	John J. Cizek	—	X	C
16	415719-772635	Knoxville Borough	—	—	O	P
17	415717-772550	Schoonover Dairy	—	—	O	N
18	415625-772448	Kizer, D.	—	1930	X	H
19	415602-772432	Merrick, H.	John J. Cizek	1930	O	H
20	413339-771903	Campbell, E.	Alexander	—	X	H
21	413534-771736	Campbell, H.	John J. Cizek	—	O	H
27	414224-771521	Wellsboro Borough	Leon Wood	—	X	P
29	414455-771719	Borden Co. of Pennsylvania	—	—	X	N
30	414457-771722	do.	—	—	X	T
31	414458-771746	Corning Glass	—	—	W	N
32	414449-771819	Parkview Hotel	John J. Cizek	—	X	H
33	413923-772206	Callahan, F.	Knapp	—	X	H
36	414438-772547	Pronty Handle Co.	John J. Cizek	—	X	N
39	415034-771624	Center Milk Products Co.	do.	1935	X	N
41	414503-770510	Carlson, F.	William Rogers	—	X	S
42	414621-770913	Hubbard, W.	Alexander	—	X	S

## RECORD OF WELLS AND TEST HOLES

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(Continued)

Altitude of land surface (feet)	Aquifer	Depth of well (feet)	Water level							
			Casing		Depth below land surface (feet)	Date measured (mo/yr)	Reported yield (gal/min)	Specific conductance (μmho/cm)	Hardness, as CaCO <sub>3</sub> (mg/L)	Well number
			Depth (feet)	Diameter (inches)						
1,470	Dck	50	35	6	4	7/85	25	175	85	Po-262
1,540	Dck	125	72	6	35	6/81	14	2,020	170	263
1,410	MDhm	135	59	6	75	11/78	20	110	50	264
1,470	—	—	—	—	13	7/85	—	148	70	265
1,680	Dlh	105	74	6	—	—	8	470	200	266
1,630	Dlh	75	72	6	—	—	—	420	190	267
1,740	Dck	90	56	6	—	—	10	105	50	268
1,610	Qsd/u	41	41	6	—	—	30	168	70	269
1,590	Dlh	87	64	6	0	5/83	—	—	—	270
1,460	Dck	73	30	6	3	5/83	15	—	—	271
1,430	Dck	55	34	6	6	7/85	15	130	70	272
1,420	MDhm	100	41	6	35	11/81	25	—	—	273
1,460	Dck	120	67	6	—	—	65	190	70	274
1,750	Dlh	118	99	6	12	8/82	18	—	—	275
1,770	Dlh	115	102	6	—	—	15	—	—	276
1,470	Dlh	66	27	6	5	5/78	60	—	—	278
2,090	Dck	145	33	6	4	5/61	60	—	—	281
1,490	Qsd/u	137	122	10	30	—/72	—	—	—	282
1,490	Qsd/u	119	108	8	17	1/41	300	—	—	283
1,490	Qsd/u	130	60	6	—	—	—	—	—	284
1,490	Qsd/u	132	120	8	34	4/55	200	—	—	285
<b>COUNTY</b>										
1,300	Qsd/u	23	—	30	17	8/35	—	285	70	Ti- 1
1,170	Dck	230	117	6	20	—/35	3	—	—	3
1,160	Dck	285	130	8	20	8/35	10	—	—	4
1,120	Qsd/c	107	107	8	4	—/35	45	—	—	5
1,130	Qsd/c	106	106	8	10	—/35	400	—	—	6
1,140	Qsd/c	112	112	8	31	—/35	125	—	—	7
1,130	Dlh	175	—	8	18	8/35	50	—	—	9
1,130	Dlh	125	—	8	18	—/35	30	—	—	10
1,170	Qsd/c	160	160	6	5	8/35	4	—	—	11
1,170	Dlh	200	100	8	—	—	35	—	—	12
1,240	Dlh	116	57	6	15	8/35	16	—	—	15
1,230	Qsd/c	100	100	6	8	8/35	25	—	—	16
1,220	Qsd/u	89	89	—	11	8/35	4	—	—	17
1,340	Dlh	76	73	6	-2	8/35	12	—	—	18
1,480	Qt	63	63	6	-4	8/35	20	—	—	19
1,370	Dck	97	34	6	45	8/35	3	—	—	20
1,030	Qsd/u	35	35	6	12	8/35	30	—	—	21
1,560	Dck	500	93	8	4	8/35	24	—	—	27
1,410	Dlh	215	70	8	15	8/35	—	—	—	29
1,310	Dlh	580	70	8	50	8/35	—	—	—	30
1,300	Qsd/u	15	15	42	4	8/35	70	—	—	31
1,410	Dlh	144	106	6	18	8/35	6	—	—	32
1,370	Dck	120	16	6	60	8/35	2	—	—	33
1,140	Dck	560	43	8	20	8/35	—	—	—	36
1,160	Dck	256	112	8	18	4/35	30	—	—	39
1,240	Dlh	287	122	6	50	8/35	—	—	—	41
1,380	Dlh	112	100	6	F	8/35	10	—	—	42

Table 21.

Well location				Driller	Year completed	Type of completion	Use
Number	Lat-Long	Owner					
Ti- 43	414841-770458	Dairymen's Coop. Assoc.	William Stothoff Co.	—	—	S	N
44	414824-770455	Thompson, M.	Leon Wood	—	—	X	S
45	414559-770435	Renken Dairy	—	—	—	X	H
47	415345-770803	Sheffield Farms	Leon Wood	—	—	X	N
49	415513-770047	Dairymen's Coop. Assoc.	—	—	—	O	N
50	415526-770132	West, A.	Alexander	—	—	O	H
51	415526-770840	Capell, W.	do.	—	—	O	H
52	415106-770055	Wood, L.	Leon Wood	—	—	O	H
55	415856-770702	Dairymen's Coop. Assoc.	—	—	—	X	N
56	414722-771810	Conrail	Pennsylvania Drilling Co.	1926	—	O	P
57	414509-771316	Kohler, R.	Edwards	1935	—	X	H
58	414515-773325	Hunting Valley Inn	John J. Cizek	—	—	X	H
59	415200-773139	Roberts, R.	do.	—	—	O	H
61	415513-773203	Eberle Tanning Co.	John Myers	—	—	S	N
62	415517-773209	Renken Dairy	William Rogers	—	—	O	N
63	415515-773242	Westfield Borough	—	—	—	X	P
64	415512-773258	Borden Co. of Pennsylvania	Ben Edwards	—	—	X	N
65	415511-773302	do.	do.	—	—	X	N
66	415512-773305	Westfield Borough	John Myers	—	—	O	P
71	413313-770638	East Smithfield Farms	Leon Wood	—	—	X	N
73	413303-770922	Maudeville, H.	John J. Cizek	—	—	O	H
75	415158-765724	Garrison, H.	Leon Wood	—	—	O	H
76	415147-765728	East Smithfield Farms	do.	—	—	O	N
78	415918-765540	Bly, B.	do.	—	—	X	H
79	414138-765548	Thomas	—	—	—	X	U
100	414513-773337	U.S. Geological Survey	Germania Well Drilling Co.	1972	—	X	O
102	415411-770839	U.S. Army	U.S. Army Corps of Engineers	1973	—	O	O
103	415407-770804	do.	do.	1973	—	O	O
104	415129-771416	do.	do.	1973	—	O	O
105	414835-770457	do.	do.	1973	—	O	O
107	415129-771417	J. P. Borden and Son	Germania Well Drilling Co.	1970	—	O	H
108	415931-770837	U.S. Army	U.S. Army Corps of Engineers	1966	—	X	O
109	415921-770902	do.	do.	1977	—	O	O
110	415834-771356	do.	do.	1977	—	O	O
122	413930-770255	Blossburg Borough	—	—	—	—	P
144	415504-773305	Westfield Borough	Guaranteed Drilling Co.	1953	—	O	P
145	415427-770746	Tioga Borough Water Works	—	—	—	W	P
146	415428-770746	do.	—	1963	—	O	P
149	415924-771902	Elkland Borough Water Department	—	—	1934	W	P
150	415911-771944	do.	—	1944	—	O	P
151	415906-771903	do.	—	1953	—	S	P
152	415924-771902	do.	—	—	—	P	P
153	415925-771911	do.	—	—	—	S	P
154	414125-770357	Blossburg Hospital	—	—	—	X	P
155	414129-770402	do.	—	—	—	X	P
157	415030-771627	Middlebury Milk	Germania Well Drilling Co.	1961	—	X	N
162	414900-771159	Bureau of Forestry	do.	1961	—	X	P
163	414831-771139	do.	Theodore R. Wood	1961	—	X	H
164	414833-771144	do.	do.	1959	—	X	P
165	414851-771156	do.	do.	1959	—	X	P
166	414843-771147	do.	do.	1958	—	O	P
167	414828-771149	do.	do.	1957	—	X	H
172	414024-770406	J. P. Ward Foundry	Germania Well Drilling Co.	1974	—	O	N

(Continued)

Altitude of land surface (feet)	Aquifer	Depth of well (feet)	Water level								
			Casing		Depth below land surface (feet)	Date measured (mo/yr)	Reported yield (gal/min)	Specific conductance (μmho/cm)	Hardness, as CaCO <sub>3</sub> (mg/L)	Well number	
			Depth (feet)	Diameter (inches)							
1,140	Qsd/u	60	40	10	18	8/35	120	—	—	T1-43	
1,130	Dlh	135	75	6	50	8/35	7	—	—	44	
1,170	Dlh	168	90	6	2	8/35	1	—	—	45	
1,050	Dlh	410	40	8	20	8/35	25	—	—	47	
1,030	Qsd/u	100	100	6	—	—	50	—	—	49	
1,160	Qsd/c	90	90	6	—	—	10	—	—	50	
1,190	Qsd/u	94	94	6	—	—	8	—	—	51	
1,300	Qsd/c	102	102	6	2	—	5	—	—	52	
1,000	Qsd/u	400	70	8	15	8/35	50	—	—	55	
1,168	Qsd/c	128	124	8	4	7/85	25	310	150	56	
1,280	Dck	93.5	65	6	—	—	.5	—	—	57	
1,390	Dck	165	32	6	36	8/35	30	—	—	58	
1,660	Qsd/u	87	87	6	59	8/35	—	—	—	59	
1,390	Qsd/u	78	58	10	9	8/35	350	—	—	61	
1,370	Qsd/u	55	55	6	2	8/35	200	—	—	62	
1,370	Dlh	200	80	8	—	—	—	—	—	63	
1,170	Dlh	425	165	8	—	—	50	—	—	64	
1,370	Dlh	165	80	8	—	—	80	—	—	65	
1,380	Qsd/u	78	78	8	4	8/35	80	—	—	66	
1,520	Dck	200	40	8	18	8/35	50	—	—	71	
1,620	Qsd/u	33	33	6	9	8/35	4	—	—	73	
1,400	Qsd/u	52	52	6	—	—	—	—	—	75	
1,410	Qsd/u	32	32	8	12	8/35	88	—	—	76	
1,170	Dlh	105	75	6	-3	8/35	4	—	—	78	
1,820	MDhm	3,600	354	6	-8	8/35	25	—	—	79	
1,310	MDhm	77	67	6	36	9/72	2	320	—	100	
1,060	Qsd/u	26	—	6	8	6/73	—	—	—	102	
1,020	Qsd/u	22	—	6	9	6/73	—	—	—	103	
1,130	Qsd/u	28	28	6	16	6/73	—	—	—	104	
1,120	Qsd/u	29	29	6	4	6/73	—	—	—	105	
1,140	Dck	170	170	6	—	—	—	1,020	50	107	
1,020	Dlh	102	75	6	17	5/77	10	—	—	108	
1,000	Qsd/u	17	17	6	6	6/77	—	—	—	109	
1,110	Qsd/u	33	33	6	3	6/77	—	—	—	110	
1,420	MDhm	177	—	12	—	—	310	—	—	122	
1,430	Qsd/c	78	78	8	7	—/53	486	—	190	144	
1,040	Qsd/u	18	—	48	—	—	40	—	—	145	
1,020	Qsd/u	22	22	22	6	—	60	—	—	146	
1,150	Qsd/u	25	25	96	—	—	80	—	—	149	
1,140	Qt	23	23	8	—	—	—	—	—	150	
1,140	Qsd/c	99	97	8	12	4/53	210	—	—	151	
1,140	Qsd/c	109	109	6	—	—	130	—	—	152	
1,130	Qsd/c	82	62	12	—	—	530	—	—	153	
1,460	MDhm	390	27	8	—	—	80	—	—	154	
1,460	MDhm	295	—	—	—	—	73	—	—	155	
1,160	Dck	167	132	10	—	—	100	—	—	157	
1,610	Dck	305	—	—	94	9/62	5	—	—	162	
1,600	Dck	134	99	6	20	1/61	12	—	—	163	
1,530	Qsd/c	72	69	6	14	6/59	15	—	—	164	
1,510	Qsd/c	84	83	6	73	9/59	40	—	—	165	
1,520	Qsd/c	91	91	6	81	5/58	45	—	—	166	
1,530	Dlh	134	130	6	37	9/57	8	—	—	167	
1,350	MDhm	106	106	6	—	—	200	—	—	172	

Table 21.

Well location			Driller	Year completed	Type of completion	Use
Number	Lat-Long	Owner				
Ti-173	414353-770549	Chase, J.	Roger D. Andrews	1979	O	H
175	414319-770720	Baity, R.	Germania Well Drilling Co.	1979	O	H
176	414507-773029	Morris, R.	do.	1971	X	H
177	414501-773150	Stoneback, P.	Roger D. Andrews	1979	X	H
178	414505-773349	Eggler, T.	Germania Well Drilling Co.	1975	X	H
179	415202-773127	Robinson, D.	do.	1979	O	H
180	415125-773246	Bare, L.	do.	1980	X	H
183	415535-773144	Brookfield Township Garage	McLaughlin Well Drilling	1979	X	H
186	415610-773419	Rumsey, G.	Germania Well Drilling Co.	1980	X	P
187	415635-773451	Tubbs, D.	McLaughlin Well Drilling	1976	O	H
191	414446-772547	Bureau of Forestry	Donald K. Havens	1980	O	P
194	414505-773322	Edwards, R.	Germania Well Drilling Co.	1980	X	H
198	415810-773342	Haskins, D.	do.	1975	X	H
201	414012-773242	Zimmerman, L.	do.	1977	X	H
208	414046-771944	Shabolski, J.	do.	1979	X	H
212	415716-772619	Knoxville Borough Water Department	—	1976	—	P
213	415904-772033	Osceola Water Assoc.	Germania Well Drilling Co.	1966	S	P
214	415956-770704	Lawrenceville Water Authority	Layne-New York Co., Inc.	1974	S	P
215	415957-770658	do.	do.	1974	S	P
216	414814-771735	Wellsboro Borough	Moody Drilling Co., Inc.	1966	S	P
217	415512-773205	Eberle Tanning Co.	Lloyd-Smith	—	—	N
218	415510-773205	do.	do.	—	X	N
221	414637-772352	U.S. Fish and Wildlife Service	Pennsylvania Drilling Co.	1973	O	S
222	414637-772352	do.	do.	1973	S	S
223	414629-772349	do.	do.	1973	X	S
224	414649-772359	U.S. Geological Survey	U.S. Geological Survey	1984	S	O
225	414642-772351	do.	do.	1984	S	O
227	415240-770605	Hughes, B.	Dan Burgess	1978	O	H
228	415713-770633	Martin, L.	Germania Well Drilling Co.	1979	O	H
231	415752-770637	Frances, W.	Roger D. Andrews	1979	O	H
232	415949-770042	Middaugh, S.	W. H. Vanderhoof Drilling Co.	1978	X	H
233	415841-765934	West Jackson Church	do.	1976	X	P
234	415531-765909	Rice, J.	James C. Vanderhoof	—	X	H
235	415204-765922	Baker, B.	Dan Burgess	1978	X	H
239	415147-765530	Rowpp, D.	Roger D. Andrews	1979	X	H
240	414920-765837	Bartlett, H.	do.	1980	O	H
242	414543-765755	Wilkins, L.	Dan Burgess	1978	X	H
244	414640-765935	Ott, D.	Germania Well Drilling Co.	1980	X	H
246	414643-765915	Valimont, T.	do.	1981	X	H
249	414824-770324	Delusa, P.	Roger D. Andrews	1979	X	H
251	414428-770455	Fredrick, J.	Dan Burgess	1978	X	H
252	414422-770457	Stoudt, R.	Germania Well Drilling Co.	1974	X	H
253	414419-770456	Teed, J.	do.	1974	X	H
254	414440-770504	Adams	Roger D. Andrews	1980	O	H
256	415039-771630	Calvario, V.	Germania Well Drilling Co.	1979	X	H
257	415036-771656	Wallmann, W.	Roger D. Andrews	1979	X	H
258	415137-771829	Sassaman, G.	do.	1979	X	H
259	414923-771907	Olshefski, F.	do.	1979	O	H
262	414608-771706	Gross, M.	Germania Well Drilling Co.	1979	X	H
263	414706-771801	Dilley, R.	do.	1980	X	H
264	414610-772113	Marsh Creek Church	Roger D. Andrews	1978	O	P

(Continued)

Altitude of land surface (feet)	Aquifer	Depth of well (feet)	Water level								
			Casing		Depth below land surface (feet)	Date measured (mo/yr)	Reported yield (gal/min)	Specific conductance (μmho/cm)	Hardness, as CaCO <sub>3</sub> (mg/L)	Well number	
			Depth (feet)	Diameter (inches)							
1,300	Qt	42	42	6	—	—	30	430	190	Ti-173	
1,470	Qt	72	72	6	F	2/79	10	—	—	175	
1,230	Dck	63	24	6	—	—	12	—	—	176	
1,220	Dck	87	21	6	—	—	20	—	—	177	
1,280	Dck	67	39	6	19	7/81	6	—	—	178	
1,660	Qsd/c	96	96	6	5	10/79	9	—	—	179	
1,710	Dlh	115	102	6	9	7/81	50	—	—	180	
1,370	Dck	105	75	6	F	9/79	—	—	—	183	
1,460	Dck	142	67	6	0	12/80	12	590	105	186	
1,510	Qsd/u	77	77	6	—	—	—	—	—	187	
1,140	Qsd/u	100	100	6	50	5/80	32	190	105	191	
1,290	Dck	150	—	6	80	10/80	20	—	—	194	
1,790	Dck	87	66	6	F	7/81	8	350	240	198	
1,600	Dck	63	21	6	46	6/77	21	—	—	201	
1,670	Dck	79	72	6	59	11/79	126	—	—	208	
1,240	Dlh	165	—	8	—	—	72	—	—	212	
1,170	Qsd/c	217	196	8	—	—	350	—	175	213	
990	Qsd/u	30	12	12	12	5/74	130	—	150	214	
990	Qsd/u	33	14	12	12	6/74	133	—	115	215	
1,180	Qsd/c	106	86	8	0	6/83	198	230	120	216	
1,320	Qsd/c	69	69	10	9	—	—	—	—	217	
1,360	Dlh	154	—	10	20	2/71	490	—	—	218	
1,160	Qsd/u	115	115	—	8	9/73	13	—	35	221	
1,160	Qsd/u	118	80	14	9	9/73	250	—	—	222	
1,150	Qsd/u	65	62	—	2	11/73	—	—	—	223	
1,190	Qsd/u	34	29	2	17	7/84	—	—	—	224	
1,170	Qsd/u	45	40	2	16	7/84	—	—	—	225	
1,060	Qsd/u	60	60	6	20	8/78	20	—	—	227	
1,020	Qsd/c	141	141	6	120	11/79	5	—	—	228	
1,000	Qsd/c	76	76	6	—	—	10	—	—	231	
1,810	Dlh	240	32	6	165	5/78	10	—	—	232	
1,470	Dlh	140	96	6	0	9/76	7	—	—	233	
1,560	Dlh	115	75	6	—	—	12	605	105	234	
1,440	Dlh	82	47	6	0	11/78	5	—	—	235	
1,640	Dck	85	72	6	—	—	20	—	—	239	
1,360	Qt	61	61	6	—	—	7	—	—	240	
1,620	Dck	112	68	6	8	7/78	12	265	120	242	
1,450	Dlh	106	36	6	40	9/80	4	—	—	244	
1,520	Dlh	221	203	6	70	7/81	9	580	100	246	
1,200	Dlh	110	31	6	12	7/81	14	—	—	249	
1,210	Dlh	92	85	6	0	8/78	14	—	—	251	
1,210	Dlh	109	77	6	13	7/81	15	525	85	252	
1,210	Dlh	125	95	6	15	7/81	15	625	120	253	
1,210	Qsd/c	85	85	6	6	7/81	10	565	155	254	
1,140	Dck	195	183	6	—	—	10	—	—	256	
1,140	Dck	220	161	6	16	7/81	30	915	85	257	
1,210	Dck	100	23	6	12	7/81	2	540	35	258	
1,410	Qsd/c	195	195	6	—	—	10	380	70	259	
1,470	Dlh	155	32	6	41	7/80	15	625	155	262	
1,210	Dlh	111	100	6	50	2/80	20	—	—	263	
1,170	Qsd/u	37	37	6	15	7/81	8	190	105	264	

Table 21.

Well location				Driller	Year completed	Type of completion	Use
Number	Lat-Long	Owner					
Ti-268	414516-772522	Blockwen, W.	Roger D. Andrews	1980	O	H	
269	414634-772352	U.S. Fish and Wildlife Service	Layne-New York Co., Inc.	1977	S	S	
270	414637-772356	do.	do.	1977	S	H	
271	414640-772351	do.	do.	1977	S	S	
272	414637-772349	do.	do.	1977	S	S	
274	415134-772452	Carpenter, K.	McLaughlin Well Drilling	—	O	H	
278	415856-772001	Stewart, G.	do.	1979	O	H	
284	415621-772442	Newberry, M.	do.	1976	O	H	
285	415911-772903	Hansel, W.	Germania Well Drilling Co.	1973	X	H	
286	415946-772958	Grist, D.	McLaughlin Well Drilling	1978	X	H	
291	415609-772934	Bieser, C.	do.	1979	O	H	
294	415907-770909	Lane Construction	Roger D. Andrews	1979	X	P	
295	415903-770907	U.S. Army	Pennsylvania Drilling Co.	1979	S	Z	
296	414642-772351	U.S. Geological Survey	U.S. Geological Survey	1984	S	O	
297	414635-772434	do.	do.	1984	S	O	
298	415904-770914	U.S. Army	Pennsylvania Drilling Co.	1979	S	O	
299	414632-772430	U.S. Geological Survey	U.S. Geological Survey	1984	S	O	
300	414632-772429	do.	do.	1984	S	O	
316	414107-772621	Henninger, W.	Roger D. Andrews	1980	O	H	
323	414450-772548	Vekkelt, F.	Germania Well Drilling Co.	1975	O	H	
324	414627-772424	U.S. Geological Survey	U.S. Geological Survey	1984	S	O	
325	414622-772419	do.	do.	1984	S	O	
334	414625-770806	Boyce, A.	Dan Burgess	1978	O	H	
343	414618-770423	Evans, R.	Roger D. Andrews	1979	O	H	
344	414650-772406	U.S. Fish and Wildlife Service	Layne-New York Co., Inc.	1977	S	O	
345	414642-772356	do.	do.	1978	S	O	
346	414639-772403	do.	do.	1977	S	O	
347	414636-772352	do.	do.	1977	S	O	
348	414622-772419	U.S. Geological Survey	U.S. Geological Survey	1984	S	O	
349	414630-772349	U.S. Fish and Wildlife Service	Layne-New York Co., Inc.	1977	S	O	
356	414623-770859	Cumming, M.	Roger D. Andrews	1980	X	H	
358	414620-770858	Burgess, D.	Dan Burgess	1979	O	H	
365	413710-765423	Chilson, K.	Willard S. Kuser	1974	X	H	
366	413627-765413	Fitch, K.	do.	1979	X	H	
367	413449-765915	Roan, R.	do.	1978	X	H	
369	413349-765722	Hemlock Ridge	do.	1980	X	H	
374	414622-772300	U.S. Geological Survey	U.S. Geological Survey	1984	P	H	
375	415948-770717	Lawrenceville Borough	Layne-New York Co., Inc.	1974	S	T	
376	415933-770735	do.	do.	1974	S	T	
377	415912-770922	U.S. Army Corps of Engineers	Pennsylvania Drilling Co.	1979	S	Z	
378	415953-770717	Lawrenceville Borough	Layne-New York Co., Inc.	1974	O	T	
379	415944-770821	do.	do.	1974	O	T	
382	415441-770225	Stone, P.	Roger D. Andrews	1979	X	H	
383	415450-770849	Bogacyzk, A.	Dan Burgess	1978	X	H	
385	415442-771301	Buffard, E.	Germania Well Drilling Co.	1980	X	H	
388	413544-771738	Vroman, L.	Roger D. Andrews	1979	O	H	
392	413351-771240	Bohart, D.	Germania Well Drilling Co.	1980	X	H	
393	413350-771239	Maneval, H.	do.	1981	X	H	
394	413350-771247	Kilpatrick, C.	do.	1980	X	H	
395	413422-771134	Black, E.	do.	1981	X	H	
396	413441-771041	Miller, C.	New Way Drilling, Inc.	1979	X	H	

(Continued)

Altitude of land surface (feet)	Aquifer	Depth of well (feet)	Water level								
			Casing		Depth below land surface (feet)	Date measured (mo/yr)	Reported yield (gal/min)	Specific conductance (μmho/cm)	Hardness, as CaCO <sub>3</sub> (mg/L)	Well number	
			Depth (feet)	Diameter (inches)							
1,160	Qsd/u	28	28	6	—	—	30	55	35	Ti-268	
1,160	Qsd/u	93	—	14	4	7/77	1,000	—	—	269	
1,170	Qsd/u	96	—	14	10	8/77	200	—	—	270	
1,170	Qsd/u	97	—	14	14	9/77	1,000	—	—	271	
1,160	Qsd/u	88	—	14	5	10/77	1,000	—	—	272	
1,550	Qt	56	56	6	—	—	—	—	—	274	
1,440	Qsd/c	99	99	6	9	7/81	—	540	85	278	
1,360	Qt	89	89	6	20	7/81	10	320	260	284	
1,330	Dlh	87	81	6	—	—	10	325	205	285	
1,380	Dlh	96	77	6	26	8/78	—	—	—	286	
1,300	Qsd/c	73	73	6	5	3/79	—	—	—	291	
1,020	Dlh	99	65	6	8	11/79	5	1,300	—	294	
1,020	Dlh	61	22	6	3	7/81	—	—	—	295	
1,170	Qsd/u	23	18	2	15	7/84	—	—	—	296	
1,180	Qsd/u	20	15	2	16	7/84	—	—	—	297	
1,020	Dlh	61	27	6	9	7/79	—	—	—	298	
1,170	Qsd/u	48	43	2	10	7/84	—	—	—	299	
1,170	Qsd/u	20	15	2	10	7/84	—	—	—	300	
1,730	Qt	31	31	6	8	7/81	10	140	85	316	
1,150	Qsd/u	34	34	6	—	—	35	—	—	323	
1,160	Qsd/u	15	10	2	10	7/84	—	—	—	324	
1,160	Qsd/u	53	43	2	7	7/84	—	—	—	325	
1,340	Qt	115	115	6	85	7/78	50	—	—	334	
1,160	Qsd/u	11	11	6	—	—	6	280	35	343	
1,200	Qsd/u	60	20	2	21	10/80	—	—	—	344	
1,180	Qsd/u	60	20	2	16	10/80	—	—	—	345	
1,170	Qsd/u	60	20	2	18	10/80	—	—	—	346	
1,160	Qsd/u	60	20	2	8	10/80	—	—	—	347	
1,160	Qsd/u	16	11	2	6	7/84	—	—	—	348	
1,150	Qsd/u	60	20	2	3	10/80	—	—	—	349	
1,370	Dlh	99	87	6	2	7/81	7	810	140	356	
1,380	Qsd/u	24	24	6	3	3/79	15	—	—	358	
1,700	Dck	240	17	6	23	8/81	8	495	20	365	
1,690	Dlh	220	42	6	74	8/81	7	—	—	366	
1,550	Dlh	100	90	6	14	7/78	15	—	—	367	
1,010	Dck	250	20	6	90	9/80	2	—	—	369	
1,160	Qsd/u	15	10	2	—	—	—	—	—	374	
980	Qsd/u	72	20	6	9	5/74	43	—	—	375	
990	Qsd/u	87	20	6	6	5/74	60	—	—	376	
1,020	Dlh	34	11	6	7	7/81	14	—	—	377	
1,000	Qsd/u	71	—	—	—	—	—	—	—	378	
1,000	Qsd/u	70	—	—	—	—	—	—	—	379	
1,040	Dlh	118	100	6	—	—	30	—	—	382	
1,060	Dlh	112	—	6	24	5/78	5	405	205	383	
1,370	Dlh	110	99	6	25	9/80	12	—	—	385	
1,050	Qsd/u	87	92	6	—	—	25	—	—	388	
1,490	Dck	39	21	6	15	11/80	20	—	—	392	
1,470	Dck	40	35	6	7	4/81	15	190	50	393	
1,490	Dck	103	29	6	40	8/80	60	195	35	394	
1,540	Dck	59	31	6	10	1/81	6	—	—	395	
1,700	Dck	200	61	6	70	6/79	8	220	70	396	

Table 21.

Well location		Owner	Driller	Year completed	Type of completion	Use
Number	Lat-Long					
Ti-398	414746-771806	Dresser Industries	—	1956	S	N
399	414733-771808	Formost Ag Service	Germania Well Drilling Co.	1982	O	C
401	415040-771625	Earney, A.	do.	1982	O	H
402	415137-771823	Sweet, L.	Roger D. Andrews	1982	O	H
403	415906-771651	McLean, B.	McLaughlin Well Drilling	1968	O	H
404	415514-772148	Carl, W.	Roger D. Andrews	1980	O	H
405	414624-772118	Webster, W.	Germania Well Drilling Co.	1967	O	H
406	414637-772244	Miller, R.	do.	1979	O	H
408	414539-772457	Connelly, K.	do.	1972	O	H
409	414901-771230	Rexford, M.	do.	1974	O	H
410	415002-771715	Tayton, R.	do.	1974	O	H
411	414956-771718	Barger, J.	do.	1974	O	H
412	414958-771716	Ingerick, T.	do.	1973	O	H
413	414959-771716	Wiswell, E.	do.	1973	O	H
414	414505-773014	Larrison, J.	do.	1968	O	H
415	414505-773014	McCullough, E.	do.	1967	O	H
416	415156-773039	Eldridge, R.	McLaughlin Well Drilling	1982	O	H
417	415233-772354	Perry, C.	Roger D. Andrews	1980	O	H
419	415557-773001	Tubbs, B.	Germania Well Drilling Co.	1969	O	H
420	415354-772846	Ackley, W.	do.	1967	O	H
421	415519-773333	MacKnight, D.	McLaughlin Well Drilling	1982	O	H
422	415358-773406	Quinn, J.	Germania Well Drilling Co.	1968	O	H
423	415644-773447	Lab Rabs	McLaughlin Well Drilling	1982	X	S
424	415449-773614	Faye, R.	do.	1981	O	H
425	415911-772859	Baker, R.	do.	1978	O	H
426	415942-772927	Schoonover, R.	Germania Well Drilling Co.	1981	O	H
427	415907-772804	Rutherford, E.	do.	1982	X	H
428	415933-772949	Carr, G.	McLaughlin Well Drilling	1967	O	H
429	415428-770953	Dilly, R.	Germania Well Drilling Co.	1972	O	H
430	415539-770515	Bastian, J.	M. S. Mattison	1969	O	H
432	415958-770647	Swartzle, P.	Germania Well Drilling Co.	1981	X	H
433	414702-770939	M. B. L. Tech. Service	Dan Burgess	1978	X	N
434	415146-765721	Dzuiba, P.	do.	1983	O	H
436	414452-770607	Coons, I.	Germania Well Drilling Co.	1969	O	H
439	414139-765548	Ayres, L.	Willard S. Kuser	1982	X	H
441	413850-772647	Bureau of Forestry	Donald K. Havens	1982	X	H
442	413420-772004	Eby, J.	Harris W. Barto	1970	X	H
443	413425-772008	Lone Oak Hunt Club	Germania Well Drilling Co.	1968	O	H
444	414353-771513	Huck, N.	do.	1968	O	H
445	414125-771726	Coolidge, L.	do.	1982	O	H
446	415213-772930	Schilder, J.	McLaughlin Well Drilling	1983	O	H
447	415550-765609	J. C. Baptist Church	W. H. Vanderhoof Drilling Co.	1983	O	H
448	415443-770833	Stone, P.	Germania Well Drilling Co.	1983	O	H
449	415441-770833	Wilson, H.	do.	1983	O	H
450	414934-771822	Wood, R.	do.	1984	O	H
451	414622-770938	Cooney, T.	Roger D. Andrews	1982	O	H
452	414658-770410	R. V. Martin Oil Co.	Germania Well Drilling Co.	1975	X	H
453	414716-765903	Johnson, F.	Roger D. Andrews	1984	O	H
454	414713-770043	Hobbs, E.	do.	1982	O	H
455	413917-770240	Rutherford, W.	do.	1982	O	H
456	414924-771711	Smith, R.	do.	1983	O	H
457	414931-771715	Graham, J.	Germania Well Drilling Co.	1984	O	H
458	415721-772511	Mellon, J.	McLaughlin Well Drilling	1983	O	H
459	415741-765528	Eighmey, B.	Donald K. Havens	1983	O	H
460	415742-765527	Fleming, M.	Donald K. Havens	1983	O	H

(Continued)

Altitude of land surface (feet)	Aquifer	Depth of well (feet)	Casing		Water level					Well number
			Depth (feet)	Diameter (inches)	Depth below land surface (feet)	Date measured (mo/yr)	Reported yield (gal/min)	Specific conductance (μmho/cm)	Hardness, as CaCO <sub>3</sub> (mg/L)	
1,190	Qsd/u	90	—	—	—	—	150	—	—	Ti-398
1,176	Qsd/u	41	41	6	4	6/83	20	155	70	399
1,150	Qsd/u	35	31	6	7	8/84	20	700	85	401
1,210	Qsd/u	22	22	6	—	—	20	—	—	402
1,160	Qsd/u	120	120	6	60	1/68	—	—	—	403
1,730	Qsd/u	46	46	6	—	—	20	—	—	404
1,150	Qsd/u	36	36	6	—	—	30	—	—	405
1,150	Qsd/u	47	47	6	0	7/83	15	—	—	406
1,140	Qsd/u	52	52	6	—	—	30	—	—	408
1,530	Qsd/c	126	126	6	—	—	20	—	—	409
1,190	Qsd/u	137	137	6	—	—	5	—	—	410
1,190	Qsd/u	120	120	6	—	—	20	—	—	411
1,190	Qsd/u	148	148	6	44	7/83	20	150	85	412
1,190	Qsd/u	126	126	6	35	7/83	5	142	70	413
1,200	Qsd/u	38	38	6	—	—	30	—	—	414
1,650	Qsd/c	91	91	6	30	1/67	18	—	—	415
1,850	Qt	130	130	6	—	—	—	—	—	416
1,400	Qsd/u	43	43	6	—	—	30	—	—	417
1,330	Qsd/c	100	100	6	—	—	15	—	—	419
1,490	Qsd/c	87	87	6	60	1/67	20	—	—	420
1,480	Qsd/u	64	64	6	17	9/82	25	—	—	421
1,640	Qsd/c	108	112	6	—	—	15	—	—	422
1,560	Dlh	180	124	6	50	7/82	7	—	—	423
1,570	Qsd/u	62	62	6	25	10/81	10	—	—	424
1,340	Qsd/u	77	77	6	0	8/78	—	—	—	425
1,390	Qsd/u	111	111	6	40	9/81	12	—	—	426
1,370	Dlh	175	118	6	40	12/82	20	—	—	427
1,380	Qsd/c	95	95	6	2	1/67	—	—	—	428
1,080	Qsd/u	23	23	6	5	8/72	15	—	—	429
1,200	Qt	65	65	6	30	5/69	5	—	—	430
1,050	Dlh	120	85	6	62	7/83	15	280	70	432
1,470	Dlh	81	45	6	9	7/83	12	505	240	433
1,350	Qsd/u	19	19	6	8	7/83	25	190	120	434
1,430	Qt	117	117	6	—	—	18	—	—	436
1,830	MDhm	150	53	6	—	—	12	—	—	439
1,090	Dlh	82	44	6	13	6/82	50	—	—	441
1,070	Dck	53	38	6	—	—	15	—	—	442
950	Qsd/u	37	37	6	—	—	30	—	—	443
1,470	Qt	107	107	6	—	—	24	—	—	444
1,550	Qt	25	25	6	8	7/83	20	230	120	445
1,620	Qt	93	93	6	0	4/83	10	—	—	446
1,460	Qsd/u	62	62	6	—	—	20	—	—	447
1,050	Qsd/u	44	44	6	3	8/84	30	400	165	448
1,060	Qsd/c	81	81	6	6	8/84	12	350	155	449
1,280	Qt	119	119	6	1	8/84	3	420	105	450
1,400	Qt	75	75	6	—	—	7	—	—	451
1,160	Dlh	135	82	6	—	—	10	—	—	452
1,470	Qsd/u	28	28	6	—	—	10	—	—	453
1,420	Qt	93	93	6	51	8/84	6	520	205	454
1,440	Qsd/u	13	13	6	—	—	20	—	—	455
1,200	Qsd/u	62	62	6	17	8/84	20	240	105	456
1,190	Qsd/u	28	28	6	0	2/84	40	—	—	457
1,280	Qsd/u	60	60	6	6	5/83	12	—	—	458
1,250	Qsd/u	54	54	6	—	—	50	360	155	459
1,250	Qsd/u	52	52	6	—	—	100	—	—	460

Table 21.

Well location		Owner	Driller	Year completed	Type of completion	Use
Number	Lat-Long					
Ti-461	415237-772405	Hunter, W.	Germania Well Drilling Co.	1983	O	H
462	413946-772148	Belcher, T.	Roger D. Andrews	1984	O	H
463	414004-772137	Keck, D.	do.	1983	O	H
464	414633-772351	U.S. Fish and Wildlife Service	Pennsylvania Drilling Co.	1973	S	T
465	414633-772350	do.	do.	1973	S	T
466	414633-772351	do.	do.	1973	S	T
467	414632-772351	do.	do.	1973	S	S
468	414626-772346	do.	do.	1973	—	T
469	414627-772348	do.	do.	1973	—	T
470	414634-772358	do.	Eichelberger Well Drilling	1984	P	O
471	414631-772425	U.S. Geological Survey	do.	1984	P	O
472	414622-772425	Walker, S.	—	—	O	H
473	414633-772436	Cleveland, C.	—	—	—	H
474	414640-772221	Bent Barrel Club	—	—	—	H
475	414611-772117	Christie, R.	—	—	O	H
476	414634-772358	U.S. Fish and Wildlife Service	Pennsylvania Drilling Co.	1977	S	O
477	414629-772122	Terrell, T.	Germania Well Drilling Co.	1984	O	H
478	414622-772415	Peterson, A.	do.	1980	O	H
479	414614-772252	Ward, L.	do.	1966	—	H
480	414620-772247	Ruland, C.	do.	—	—	H
481	414729-772010	Webster, L.	do.	—	—	H
482	414640-772230	Cooper, D.	Roger D. Andrews	1977	X	H
483	414630-772358	Bowers, G.	—	—	T	H
484	414632-772404	do.	—	—	T	I
485	414623-772411	Faivre, G.	—	—	T	S
486	414619-772425	Decker, E.	Roger D. Andrews	1984	X	H
487	415934-770727	Lawrenceville Borough	Layne-New York Co., Inc.	1974	S	T
488	415932-770654	do.	do.	1974	S	T
489	415934-770836	do.	do.	1974	—	T
490	414933-770717	do.	do.	1974	S	T
491	415936-770846	do.	do.	1974	P	T
492	415936-770846	do.	do.	1974	S	T
493	415939-770846	do.	do.	1974	—	T
494	415940-770847	do.	do.	1974	—	T
495	415903-770701	Osgood, C.	Germania Well Drilling Co.	1980	X	H
496	415416-770841	Holloway Companies	do.	1974	O	C
497	415431-770748	Tioga Borough	Vern A. Penner	1981	S	P
498	414723-771816	Conrail	Roger D. Andrews	1984	X	O
499	414629-772351	Giddings, R.	Coudersport Well Drilling	1985	S	H
500	414632-772358	Butler, M.	do.	1985	S	H
501	414633-772400	Faivre, C.	do.	1985	S	H
502	414631-772400	Bowers, G.	do.	1985	S	H
503	414631-772404	do.	do.	1985	S	H
504	414629-772407	Butler, A.	do.	1985	S	H
505	414627-772406	Faivre, G.	do.	1985	S	H
506	414628-772408	Faivre, A.	do.	1985	S	H
507	414625-772413	Medvid	do.	1985	S	H
508	414624-772411	Faivre, G.	do.	1985	S	H
509	414623-772413	Peterson, M.	do.	1985	S	H
510	414627-772406	Faivre, G.	—	1960	T	H
511	414709-771809	Conrail	—	—	O	U
512	414733-771803	Cavanaugh	—	—	—	—

(Continued)

Altitude of land surface (feet)	Aquifer	Depth of well (feet)	Water level								
			Casing		Depth below land surface (feet)	Date measured (mo/yr)	Reported yield (gal/min)	Specific conductance (μmho/cm)	Hardness, as CaCO <sub>3</sub> (mg/L)	Well number	
			Depth (feet)	Diameter (inches)							
1,390	Qsd/u	39	39	6	5	5/83	10	—	—	Ti-461	
1,370	Qsd/u	33	33	6	—	—	9	—	—	462	
1,390	Qsd/u	21	21	6	—	—	10	—	—	463	
1,160	Qsd/u	102	62	5	4	9/73	13	—	—	464	
1,160	Qsd/u	110	70	5	4	9/73	13	—	—	465	
1,160	Qsd/u	102	62	5	5	9/73	13	—	—	466	
1,160	Qsd/u	106	85	14	4	11/73	250	—	—	467	
1,150	Qsd/u	61	—	—	—	—	—	—	—	468	
1,150	Qsd/u	64	—	—	—	—	—	—	—	469	
1,160	Qsd/u	73	69	6	8	9/84	80	—	—	470	
1,170	Qsd/u	47	42	6	13	12/84	80	—	—	471	
1,160	Qsd/u	85	—	6	12	5/84	—	—	—	472	
1,180	—	—	—	—	15	12/84	—	—	—	473	
1,180	—	90	—	—	27	10/84	—	—	—	474	
1,170	Qsd/u	23	23	6	12	5/84	—	—	—	475	
1,160	Qsd/u	30	20	2	8	10/80	—	—	—	476	
1,160	Qsd/u	38	38	6	—	—	20	330	—	477	
1,150	Qsd/u	—	—	—	3	6/84	—	60	70	478	
1,180	Dck	—	—	—	16	6/84	—	—	—	479	
1,160	—	—	—	—	11	6/84	—	—	—	480	
1,190	—	—	—	—	33	6/84	—	360	120	481	
1,180	Dlh	118	77	6	10	6/84	—	75	35	482	
1,160	Qsd/u	9	7	1	4	6/84	—	—	—	483	
1,160	Qsd/u	17	15	1	6	6/84	—	—	—	484	
1,150	Qsd/u	17	15	1	3	6/84	—	—	—	485	
1,160	Dck	124	122	6	11	5/84	3	—	—	486	
980	Qsd/u	30	20	6	11	5/74	23	—	—	487	
1,020	Qsd/u	40	30	6	—	—	3	—	—	488	
990	Dlh	47	—	—	—	—	—	—	—	489	
1,000	Qsd/u	30	20	6	8	5/74	75	—	—	490	
1,010	Qsd/u	24	18	6	9	8/74	15	—	—	491	
1,010	Dlh	150	70	—	—	—	42	—	—	492	
1,010	Dlh	60	—	—	—	—	—	—	—	493	
1,010	Dlh	60	—	—	—	—	—	—	—	494	
1,020	Dlh	115	81	6	80	1/80	40	—	—	495	
1,060	Qsd/u	79	79	6	—	—	60	—	—	496	
1,030	Qsd/u	23	18	10	9	8/81	100	—	—	497	
1,170	Dlh	158	149	6	4	7/84	23	1,075	275	498	
1,150	Qsd/u	81	77	6	9	11/85	23	110	70	499	
1,160	Qsd/u	86	82	6	6	11/85	12	—	—	500	
1,160	Qsd/u	86	81	6	6	11/85	23	90	50	501	
1,160	Qsd/u	90	85	6	6	11/85	23	—	—	502	
1,160	Qsd/u	77	72	6	10	11/85	22	85	70	503	
1,160	Qsd/u	94	89	6	10	11/85	7	51	110	504	
1,160	Qsd/u	78	73	6	9	11/85	18	66	35	505	
1,160	Qsd/u	77	72	6	8	11/85	6	60	35	506	
1,160	Qsd/u	81	77	6	5	12/85	23	50	35	507	
1,150	Qsd/u	75	71	6	6	11/85	12	59	35	508	
1,160	Qsd/u	81	77	6	6	11/85	23	50	35	509	
1,150	Qsd/u	15	13	1	8	9/85	—	—	—	510	
1,170	Qsd/c	—	124	6	5	7/85	21	340	140	511	
1,170	Qsd/c	50	—	—	5	8/85	5	290	85	512	

Table 21.

Well location		Owner	Driller	Year completed	Type of completion		Use
Number	Lat-Long						
Ti-513	414733-771801	Pennsylvania Bureau of Topographic and Geologic Survey	Donald K. Havens	1985	S	O	
515	415447-773617	Wheaton, K.	McLaughlin Well Drilling	1983	X	H	
516	414944-771711	Mucci, J.	Roger D. Andrews	1984	O	H	
517	415727-772501	Fish, W.	McLaughlin Well Drilling	1984	O	H	
518	414850-771152	Bureau of Forestry	Germania Well Drilling Co.	1968	O	P	
519	414439-770439	Covington Post Office	New Way Drilling, Inc.	1984	X	H	
520	415906-772047	Beard	—	1984	—	H	
521	415852-772050	Moser, C.	—	1984	—	H	
522	415845-771521	Nelson Municipal Water	Layne-New York Co., Inc.	1979	S	P	
523	414839-770409	Mansfield University	—	—	—	T	
524	414840-770415	do.	Moody Drilling Co., Inc.	1971	P	T	
525	414837-770408	do.	do.	1971	P	T	
526	414837-770406	do.	do.	1971	S	T	
527	415605-770617	U.S. Geological Survey	U.S. Geological Survey	1983	P	O	
528	415808-770618	Interstate Manufacturing Lease	Germania Well Drilling Co.	1975	—	C	
529	415608-770625	Caywood	—	1983	—	H	
530	415607-770625	Elms Tavern	—	1984	—	H	
531	415738-772639	Wood, C.	—	—	X	U	
532	414508-773320	Hunting Valley Inn	—	—	X	P	
533	415513-773203	Eberle Tanning	—	1935	X	N	
534	415040-771625	Earney, A.	Germania Well Drilling Co.	1984	O	H	
535	415936-771836	Elkland Leather	—	1935	—	N	
536	414639-772340	Tighe	Germania Well Drilling Co.	1985	X	H	
537	415515-773301	Westfield Borough Water Works	—	1981	S	P	
538	414750-771809	Dresser Industries	Donald K. Havens	1986	S	O	
539	414747-771805	do.	do.	1986	S	O	
540	414742-771804	do.	do.	1986	S	O	
541	414627-772347	U.S. Fish and Wildlife Service	David V. Lewin	1975	—	T	
542	414629-772345	do.	do.	1975	—	T	
543	414632-772347	do.	do.	1975	—	T	

## RECORD OF WELLS AND TEST HOLES

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(Continued)

Altitude of land surface (feet)	Aquifer	Depth of well (feet)	Casing		Water level					
			Depth (feet)	Diameter (inches)	Depth below land surface (feet)	Date measured (mo/yr)	Reported yield (gal/min)	Specific conductance (μmho/cm)	Hardness, as CaCO <sub>3</sub> (mg/L)	Well number
1,170	Qsd/c	142	132	4	2	12/85	35	290	—	Ti-513
1,470	Dlh	67	56	6	F	11/83	—	380	190	515
1,180	Qsd/u	34	34	6	8	7/85	15	210	85	516
1,220	Qsd/c	149	149	6	F	7/85	6	395	155	517
1,520	Qsd/c	91	91	6	26	6/68	35	250	155	518
1,200	Dlh	170	100	6	24	7/85	5	420	155	519
1,180	Qsd/c	200	—	—	25	7/84	—	—	—	520
1,180	Qsd/c	—	119	—	—	—	30	—	—	521
1,100	Qsd/c	74	69	—	11	9/79	15	—	—	522
1,160	Dlh	—	50	—	—	—/71	120	—	—	523
1,160	Qt	51	44	8	F	9/71	30	—	—	524
1,160	Qt	50	28	8	6	8/71	30	—	—	525
1,160	Qt	42	37	8	5	11/71	70	—	—	526
1,030	Qsd/c	122	117	2	12	7/84	—	—	—	527
1,030	Qsd/c	130	130	5	21	10/75	30	—	—	528
1,020	—	140	—	—	11	7/84	—	—	—	529
1,020	—	146	—	—	—	—	—	—	—	530
1,250	Dck	212	—	—	—	—	—	—	—	531
1,290	Dck	265	—	—	—	—	—	—	—	532
1,390	Dck	185	—	—	—	—	—	—	—	533
1,140	Qsd/c	149	149	6	10	8/84	10	310	120	534
1,250	Qsd/c	116	—	—	31	—/35	400	—	—	535
1,155	Dck	114	35	6	8	12/85	36	—	—	536
1,390	Qsd/u	80	45	—	4	3/81	585	—	—	537
1,193	Qt	51	46	2	21	11/86	—	—	—	538
1,186	Qsd/u	59	49	2	20	11/86	—	—	—	539
1,180	Qsd/u	59	49	2	13	11/86	—	—	—	540
1,150	Qsd/u	—	—	—	6	6/75	—	—	—	541
1,146	Qsd/u	—	—	—	3	6/75	—	—	—	542
1,144	Qs	—	—	—	—	—	0	—	—	543

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